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THE RAILWAY MAN'S SUNDAY.

THE

RAILWAYS OF ENGLAND.

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MIDLAND.
GREAT NORTHERN.
M. S. & L. (GREAT CENTRAL).
NORTH EASTERN.

SOUTH WESTERN.
GREAT WESTERN.
GREAT EASTERN.
BRIGHTON AND SOUTH COAST.
CHATHAM AND DOVER.
SOUTH EASTERN.

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By W. M. ACWORTH.

FIFTH EDITION.

WITH 67 ILLUSTRATIONS.

LONDON
IAN ALLAN
Originaliy published by
JOHN MURRAY, ALBEMARLE STREET.
1900.

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TO

THE THREE HUNDRED THOUSAND SERVANTS
OF THE PUBLIC,

WHO ARE AT WORK BY NIGHT AS WELL AS BY DAY, IN FOG
AS WELL AS IN SUNSHINE, UPON

THE RAILWAYS OF ENGLAND;

WHO, WHETHER THEY BE CHAIRMEN AND GENERAL MANAGERS, OR
SIGNALMEN, DRIVERS, AND PLATELAYERS, MUST INDIVIDUALLY BEAR
THE BLAME OF FAILURE, WHILE THE CREDIT OF SUCCESS GOES TO
THE COMPANY, AND THE PROFIT TO THE SHAREHOLDERS
AND THE COUNTRY AT LARGE,

THIS BOOK IS

Dedicated

AS A TRIBUTE,
NOT ONLY OF GRATITUDE FOR ASSISTANCE
BUT OF SINCERE ADMIRATION.

PREFACE TO THE PRESENT (FIFTH) EDITION.

THIS book, which was first published about ten years ago, and has since gone through four editions, has now been for some time out of print.

Great changes have during the decade taken place on English railways. Every company except two has a new chairman, and every company except one a new general manager. The pioneers of our English railway system who were still alive in 1889 are now all gone—Sir Daniel Gooch, Sir James Allport, Mr. Samuel Laing. Mr. Gladstone was the last survivor. The number of the staff, estimated in 1888 as under 350,000, was found, by actual enumeration, to be 534,000 in 1898. Though the mileage of line open has only increased by about 9 per cent., the paid-up capital has increased 25 per cent. Nearly three hundred millions have been added to the annual number of passenger journeys, or, roughly speaking, three million passengers travel every week, against only two millions ten years ago. Gross receipts have risen nearly seventeen millions sterling, but of this sum less than four millions is new net profit, the whole of the residue having been absorbed by increased working expenses. *Bradshaw* has grown from 600 to 1000 pages. Evidently 1899 is not as 1889. In these circumstances there seemed to be open to the author the proverbial three courses.

To rewrite the book I have neither time—the collection of the original materials implied months of travelling and visits, often in the dead of night, to scores of inaccessible places—nor indeed capacity. Whatever of interest the general reader may have found in the book is due to the fact that it endeavoured to reproduce the vivid impression of a new-comer in an unexplored field. After living ten years on the spot one is apt not to record, but to question, to criticise, and to compare; and criticisms and comparisons in technical matters would only be wearisome to the non-technical reader.

Yet I am reluctant to allow the book to die. There is still, I am told, a steady demand for it, and though more books descriptive of English railways have been published in the last ten years than in the previous thirty, there is none which, as far as I know, covers quite the same ground. Moreover, in its main features the work of our railways goes on unaltered. Letters are still sorted and handled in the old fashion, whether at the G.P.O. or in the T.P.O.; goods are loaded and unloaded with the same "sweaty haste" at London Road and Broad Street, and shunted and marshalled in the same manner at Chaddesden and Edgehill; coal is still dealt with by the million tons at Cardiff and Toton, and passengers by tens of thousands at Chingford and Doncaster. The description of such places as they were ten years ago is practically a description of them as they are to-day.

The present edition is therefore, with slight alterations, a reprint of the original book, and except in the supplementary chapter, in which I have endeavoured to summarise the chief improvements which the last ten years have seen, describes throughout matters as they existed in 1888. That

English railways have made considerable progress between 1888 and 1899 is fortunately unquestionable. The Irish service of the North Western, for instance, is now as creditable as ten years ago it was the reverse, while the rejuvenescence of the Great Western through all its giant bulk is plain for all folks to see. But unfortunately the revision of the comparison made ten years ago, and then in the author's opinion justly made, between English and foreign railways, proves that progress abroad has been much greater than here, that not only is the gap between us fast closing up, but that in several instances we in England have distinctly fallen to the rear. It was the example of what England could do in 1888 which stimulated American and foreign railways to the vast improvements which they have made in the last ten years. Ten years hence it may perhaps be possible to find evidence of English railwaymen's readiness to learn in their turn from their rivals. But it cannot honestly be said that there is much evidence of any such readiness at the time of writing.

October, 1899.

PREFACE TO THE FIRST EDITION.

SOME two years since I went down to Liverpool and Manchester with the intention of obtaining materials for a magazine article. The result of that journey is that I have written a book which cannot even offer for itself the apology that it is only a very little one. But, before it goes forth to the world, I trust I may be forgiven for offering a few words of merely personal explanation.

I have published before now not a few criticisms (which were meant to be scathing) on English Railways anonymously. I find myself using, under my own name, the language of almost unvarying panegyric. This is partly to be explained by the plan of the book, which professes to set before the reader those points on each line which best merit description—its excellences, therefore, rather than its defects. Much more, however, is it due to a change of opinion in the writer. The more I have seen of railway management—and in the course of the last two years I have seen a good deal—the more I have realised the difficulty of the problem set before the railway authorities for solution, and the more I have appreciated the success with which, on the whole, they have solved it. I have found in so many cases that a satisfactory reply existed to my former criticisms, that I have perhaps assumed that such an answer would

be forthcoming in all; and, if I have taken up too much the position of an apologist, where I should have been content to be merely an observer, let me plead as my excuse that I am only displaying the traditional zeal of the new-made convert.

Further, it seems only right to disclaim any idea that what I have written is a complete and symmetrical gazetteer of the whole English railway world. I have only professed to deal with railways terminating in the Metropolis. The mention of the rest is only incidental and complementary to these. Again, "Never refuse traffic" is the motto of every railway manager in the country, and there is not a line but carries passengers, and goods, and minerals of all classes. I have, however, as a rule, dealt with each class of traffic but once, and described it under the railway in whose business it formed the most prominent feature. Without this explanation it might seem invidious—to take instances from the first two lines mentioned in the book—to ignore the fact that the Midland carries many millions of letters, and that the North Western carries many million tons of coal.

I have also to express my much more than merely conventional gratitude to the officials and servants of the various companies, without whose assistance—as must indeed be obvious on every page—this book could never have been written at all. To mention each of them by name is impossible; to do so would be to run through the list of the heads of departments of almost all the great lines in the country. And even then I should have neglected to thank innumerable inspectors, signalmen, and engine-drivers, and others, who have contributed

not a little to my education and instruction. From the universal readiness to permit an outsider to go where he liked, and see what he liked, and to get answers to any questions he chose to put, it would appear that English railway managers can have but few skeletons in their cupboards. I have also to thank the authorities of the Post Office for the facilities which they have in all cases courteously placed at my disposal.

Finally, I must make a special acknowledgment of the kindness to which I am indebted for the various illustrations. In particular I have to thank Mr. Findlay and Mr. Footner for leave to reproduce their diagrams of Edge Hill, Mr. Cameron Swan for a photograph of the apparatus of the Travelling Post Office in action, Mr. Fay for the picture of Waterloo in 1848 (as well as for the information in his book on the South Western line), Mr. Arthur Guest for the drawing of the Liverpool and Manchester Company's trains, the Editor of the *Railway News* for the illustration of the patent "feather-bed train," Messrs. Ransome and Rapier for the illustration of the hydraulic buffers at St. Paul's Station, and Mr. W. C. Boyd for the caricature referring to the old Eastern Counties. The rest of the modern illustrations I owe in almost every case to the courtesy of the officials of the different lines concerned.

January, 1889.

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THE

RAILWAYS OF ENGLAND.

CHAPTER I.

INTRODUCTORY SKETCH OF THE HERO'S BOYHOOD.

Our English railways, what they are, what they do, and how they do it, is the subject of this book. The fitting introduction would therefore be a historical account tracing the growth of the English railway system from its humble beginnings in wagons slowly dragged by horses along the stone or wooden tramroads of some remote colliery district two centuries back, down to its latest development in expresses, careering for two hours on end at the rate of a mile a minute along gleaming "edge-rails" of polished steel at the tail of a Webb or a Worsdell "compound." But the history of English railways still remains to be written; and when the hour and the man arrive—and that the time may be soon is much to be desired, as year by year records are vanishing, and month by month the last survivors of the men who made the history of our early railways are dropping off—it will not be within the limits of a single chapter that the tale will be told. Meanwhile there is, I think, one epoch that may profitably be isolated from the rest of the consecutive history of railroads, and studied for the sake of comparison with the condition of things to-day. And this epoch is in round figures the year 1843.

All the world knows that the Liverpool and Manchester

Railway was opened in 1830, and that the Railway Mania occurred in 1846. The year 1843 marks the period of transition between these two points, and enables us to sketch the English railway system in a condition more nearly approaching a stable equilibrium than it has ever attained either before or since. A long and severe depression of trade, consequent on a series of bad harvests that culminated in the Irish potato famine and the Repeal of the Corn Laws, had brought railway building almost to a standstill, and had rendered it well-nigh impossible for projectors to obtain the money for new schemes.

But the main foundations of our railway system were already laid, and with the exception of the Great Northern, and of course of the Chatham and Dover, all the great companies were already in existence, or at least in embryo. The London and Birmingham had not yet united with the Grand Junction, the Manchester and Birmingham, and the Liverpool and Manchester to form the North Western, but passengers could travel from Euston, *viâ* Birmingham and Crewe, not only to Liverpool and Manchester, but to Chester, Lancaster, and Leeds as well. To the north-east they could travel as far as Hull and Darlington, though the Hull and Selby, the Great North of England with its 44¼ miles of line, the Clarence, the Brandling Junction, and half a dozen more, not forgetting the Stockton and Darlington, squabbled and fought over different corners of the territory where now the North Eastern reigns in undisputed sovereignty. The North Midland, the Birmingham and Derby, and the Midland Counties were on the eve of amalgamation into the Midland Railway—the "Great Midland," as it was considered that a company controlling no less than 130 miles of line had a right to be called. In the eastern counties too the first of the coalitions that have finally given us the Great Eastern was just taking shape. South of the Thames, the South Eastern was open to Folkestone; the Brighton line was finished, as was the South Western to Southampton and Gosport. The Great Western was running to Bristol and to Cheltenham, while the

extension to Exeter was open beyond Taunton, and was fast approaching completion. There were also a good many lines scattered about England, from Hayle, Bodmin, and the Taff Vale, to that which was perhaps the most important of all, the Newcastle and Carlisle, but having no communication with the main railway system.

In all, some 1800 miles were open for traffic, and no great amount beyond this was under construction. The 1650 miles open at the end of 1841 had only been increased by 179 at the end of 1843. This latter year, however, saw the Parliamentary notices lodged for the Chester and Holyhead. In Ireland there was a railway from Dublin to Kingstown, and also a few miles in Ulster. In Scotland there were some local lines near Dundee, and direct communication was also open from Edinburgh to Glasgow, and on to Ayr and Greenock. But nine-tenths of the mileage was in England. The amount of capital authorised was about £70,000,000, and of this nearly £60,000,000 had already been spent. About 300,000 passengers were carried every week, and the total weekly receipts from all sources were somewhat more than £100,000. For purposes of rough comparison, it may just be mentioned that to-day (1889) there are nearly 20,000 miles of line in Great Britain, about seven-tenths of them in England and Wales, that the paid-up capital exceeds £800,000,000, that the annual receipts are more to-day than all the capital in 1843, and that the number of passengers has increased more than forty-fold.

A General Railway and Steam Navigation Guide, bearing already the familiar name of "Bradshaw," though not yet clad in the familiar yellow garb, had been for some time in existence, and had just begun to appear regularly on the first of each month; but, in spite of ample margins and wide-spaced columns, it was necessary to insert much extraneous matter relative to railways under construction and the price of shares in order to eke out the thirty-two pages of which the slim pamphlet was composed. Then, as now, its price was sixpence.

Competent observers were, however, convinced that all the lines it would pay to construct were already made. For instance, it was gravely argued that the Lancaster and Carlisle (a line that in fact paid enormous dividends for years before it was absorbed into the North Western) would prove a most disastrous speculation." It was evident, said the wiseacres, that it could never have any goods traffic; and as for passengers, "unless the crows were to contract with the railway people to be conveyed at low fares," where could they be expected to come from? The through traffic could be conveyed almost as expeditiously and far more cheaply in the "splendid steamships which run to Liverpool in sixteen or seventeen hours from Greenock." As for the rival East Coast scheme, "this most barren of all projects, the desert line by Berwick," was even more fiercely assailed. "A line of railway by the [East] coast," writes one gentleman, "seems almost ludicrous, and one cannot conceive for what other reason it can have been thought of, except that the passengers by the railway, if any, might have the amusement of looking at the steamers on the sea, and reciprocally the passengers by sea might see the railway carriages."

"The improvements that are constantly taking place in marine engines and steam vessels," writes another correspondent, "are so great that there cannot be a doubt but they will soon attain an equal rate of speed to the present railway locomotives." For all that, the East Coast route was strongly advocated, and an influential deputation, headed by Hudson and Robert Stephenson, had an interview with Sir Robert Peel at the Treasury to solicit Government assistance to the project. The construction of the High Level Bridge at Newcastle, as a single line to be worked by horses, was under consideration. Speaking of the proposed Caledonian line from Glasgow and Edinburgh to Carlisle, the *Railway Times* writes in January, 1843, that, if in any way the present attempt should be rendered nugatory, the next ten years will not see the commencement of a line to Scotland by the West

Coast.* "Long before that time the route *viâ* the East Coast will be completed, if its promoters proceed with the same spirit as heretofore; and, although ultimately there may be and must be *two* distinct lines between the capitals of England and the North, it is almost certain that, unless some great improvement takes place in the making and working of railways, the present generation will not witness the execution of both." The prophet's vision was so far correct that the East Coast was open first, but it was only the difference between July, 1847, and February, 1848.

It was urged, however, by competent authorities that the completion of "an undertaking of so much national importance" might be antedated, if the proposals of "Wm. F. Cooke, Esq., the ingenious originator and successful introducer of the system of electrical telegraphing," were adopted. That gentleman considered that "the whole present system of double way, time-tables, and signals, is a vain attempt to attain, indirectly and very imperfectly, at any cost, that safety from collisions which is perfectly and cheaply conferred by the electric telegraph." He urged the adoption of what was sometimes known as the "reciprocating" system, or what we should call single-line working. "It is not necessary that a railway should be of one construction throughout a widely varied country. A *mixed line* would convey any quantity of traffic, and might at the same time admit of an enormous reduction of prime cost. On the principle on which the width of a canal is diminished at a lock or an aqueduct, the tunnels, viaducts, high embankments, and deep cuttings of a railway might be made on the scale of a single way, expanding into the double way in a more open and level country. Let this principle be carried a little further by submitting to a reduced speed at a few sharp

* The Caledonian line was projected and surveyed by Mr. Locke as early as 1836, but the name was not invented till 1844, on the eve of the great Parliamentary contest of the following year. The Annandale, the Clydesdale, the Lanarkshire, the Evan Water, the Beattock, were some of the names by which the original scheme was known.

curves and steep gradients, introduced to accommodate a line to the natural defiles of a mountainous district, and a million might be saved on 10 or 15 miles of heavy works in a line of 150 miles in length, which for the remainder of its course would be constructed with a double way. This combination of the single and double way would be peculiarly appropriate to the case of a Scottish junction line to unite the eastern or western capital of Scotland with our English railways, a line which must on either coast include several heavy works of so expensive a nature as at present to render it very doubtful that this great national union could prove a profitable undertaking. But let the expense of these heavy works be reduced nearly one-half by contracting their scale, and the main obstacle to the undertaking is removed."

We must have another quotation from Mr. Cooke. He was, be it remembered, not only a distinguished electrical engineer, but also practically concerned in the working of railways. And this is the direction in which Mr. Cooke expected that railways would develop. One great advantage of adopting his system would, he declares, "consist in the more perfect adaptation of a railway to the wants of the country through which it passes. Passengers might be taken up, as on the Liverpool and Manchester line, at very short distances; and to save expensive stations, and prevent impatience when a train is late, a bell might be rung for some time before the arrival of a train, to publish to the neighbourhood its gradual approach. Passengers might be collected in horse carriages; and agricultural produce might be carried in wagons along the railway, in the intervals between the trains. Short branches might be worked entirely by horses, in correspondence with the trains upon the main line. Such minor sources of traffic would deserve the attention of a railway, in proportion as cheapness of construction enabled smaller returns to realise the same proportional dividend. Numerous little rills and streamlets would swell the tide of traffic; and the roadside population would at length participate in the convenience of the vast

works which have deprived them of their local conveyances; in short, many lines of railway might become what all were once intended to be, *highway-roads* open to the use of the public." Mr. Cooke's imagination, however, could not soar to the heights attained by one ingenious person who looked forward to railways benefiting the agricultural interest in a very different manner. Engines ought, he considered, "to employ their superfluous power in impregnating the earth with carbonic acid and other gases, so that vegetation may be forced forward despite all the present ordinary vicissitudes of the weather, and corn be made to grow at railway speed."

Not only was railway construction pretty much at a standstill, but there were those who were persuaded that, though railway building was a very good thing in its way, it was a thing that already had been very much overdone. Here is what the *Athenæum* wrote on the subject in May, 1843:—"With a view to the future, let us glance at the facts as they now stare us in the face; in the first place, look at the vicinity of London. Two railways—the Northern and Eastern, and the Eastern Counties, to Cambridge and to Colchester—are carried into the same district; both are unsuccessful—one might have served all the purposes of both, and perhaps neither is the line that should have been adopted. At all events, one of the two is useless—total loss, say £1,000,000. Next, to the westward, it is plain that one line should have served for the Great Western and the South Western, as far as Basingstoke and Reading—total loss, say £1,000,000. When going north, we have two lines parallel with each other, the Birmingham and Derby, and the Midland Counties, the latter of which should never have existed—total loss, £1,000,000. Then Chester and Crewe, Manchester and Crewe, and Newton and Crewe, and Chester and Birkenhead, three of them unprofitable, a total loss (without any advantage) amounting to £1,500,000. That the Manchester and Preston, and the Newton and Preston, and the Leigh and Bolton should co-exist in the same district, is a further absurdity, costing at least an unnecessary £500,000.

No one acquainted with the country can for a moment admit that both the Manchester and Leeds, and Manchester and Sheffield should have been made as separate railways, at a loss of £1,500,000. Thus might good legislation have rendered to the country two essential services. The whole traffic at present existing might have been concentrated on the remaining lines by a judicious selection, so that they would have been rendered more profitable to the country, while these six millions would have remained for investment. With this money at its disposal, our Government might now have had the following lines for conveyance of mails, which it eminently wants, viz, a mail line from Exeter to Plymouth, and its continuation for the same purpose to Falmouth; a mail line to Ireland by way of Chester and Holyhead: and a mail line north to Scotland. These great lines would have been feeders to those which already exist, would have conferred great benefits on the country, and would have cost no more than has been already paid for partial communication."

The *Athenæum* was not alone in hymning the blessings of State control. The *Artisan* for July points out that the railways of Belgium possess a great advantage over the railways of this country in the economy of their construction owing to the authority of Government, and further, "on the all-important point of safety, the system of State management, as exemplified in the railways of Belgium, far surpasses the railways of England." Convinced, however, that State control, whatever its abstract virtues, was alien to the English temperament, the writer goes on to consider whether there is no mean course available. "We turn to France, and find there is a system adopted which promises to secure the advantages of encouragement by the State with the independence of individual control."

We too can now turn to France, and, with the benefit of experience to guide us, can prove the pudding that the French people have had the privilege of eating for the last five-and-forty years. And to-day there can be but one opinion among those competent to judge, even

those who are most dissatisfied with our English railways, that the public, whether as passengers by first, second, or third class or as shippers of goods, either by *grande* or *petite vitesse*, are immeasurably worse served than they are in England. As for the system on which the French lines have been built—a system by which the Government guarantees dividends ranging from 7 to 13 per cent., and dare not call upon the companies to carry out obviously necessary extensions, lest it should in its turn be called on to make good its extravagant guarantee, while the companies, secure in the possession of a monopoly which yields them without effort an income far larger than even this guaranteed minimum, have no inducement to weight themselves with comparatively unproductive new lines—now that the *Artisan* is unfortunately defunct, it would be difficult to find for it one solitary supporter.

The entire unconsciousness even of the railway men themselves of the revolution they were working is nowhere better shown than in the different methods that were proposed for conducting the traffic. Practically the locomotive, as we have it to-day, capable of working up to 1000 horse-power, was already there. The multitubular boiler and the steam-blast had long been in common use. But neither the public nor the specialists were convinced that the right system had been hit upon. To say nothing of a "patent aerial steam-carriage which is to convey passengers, goods, and despatches through the air, performing the journey between London and India in four days, and travelling at the rate of 75 to 100 miles per hour," all kinds of substitutes for locomotives were being sought for. One day the *Globe* reports that a "professional gentleman at Hammersmith has invented an entirely new system of railway carriage, which may be propelled without the aid of steam at an extraordinary speed, exceeding 60 miles an hour, with comparative safety, without oscillation, which will no doubt become the ordinary mode of railway travelling for short distances, as the railway and carriages may be constructed and kept in repair for less

than one-fourth of the usual expense." Another day the Edinburgh and Glasgow Railway have, says a Scotch writer, "the discernment to employ Mr. Davidson, a gentleman of much practical knowledge and talent," to construct for them an electro-magnetic carriage. The carriage, 16 feet long by 7 feet wide, was duly placed upon the rails, and "propelled by eight powerful electro-magnets about a mile and a half along the railway, travelling at the rate of upwards of four miles an hour, a rate which might be increased by giving greater power to the batteries, and enlarging the diameter of the wheels." "The practicability of the scheme is," we are assured, "placed beyond doubt," and its "simplicity, economy, safety, and compactness render it a far more valuable motive power than that clumsy, dangerous, and costly machine the steam-engine."

Then, again, Messrs. Taylor and Conder, C.E., patented an ingenious system by which a carriage was to be drawn along the line "by the muscular power of the two guards who, as it is, constantly accompany it." The system, which is at the present moment in use for towing purposes on many German rivers, the Elbe for one, required that an endless rope should be laid along the line, and wound on to a drum which was attached to the carriage, and made to revolve by force, manual or mechanical, supplied from inside the carriage itself. Next Mr. England, the engineer of the London and Croydon Railway, made a manumotive railway carriage, "very light and elegant in appearance, and capable of carrying seven or eight persons at the rate of 18 miles an hour." "We have no doubt," says a railway newspaper, "that these machines will come into general use, as they will effect considerable saving to the company in the expense of running an engine." Unfortunately none of these fine promises came to much. Mr. England's manumotive carriage, under the more humble name of a trolley, is often employed on country lines to convey navvies or surface men to or from their work. And the endless rope and drum system is in some instances of unusually steep inclines used to let a train down into a

station, but it can hardly be said to have revolutionised railway travelling. Mr. Davidson, like many another inventor, was rudely checked by the cost of experiments and the stringency of the patent laws; and, after forty more years have been devoted to their improvement, electric railways are still hardly better than a scientific toy.

[In nothing appertaining to railways have the last ten years seen a greater change than in the progress of electric traction. The mileage of electric tramways in the world to-day is something like 15,000 miles. On railways proper, in London, Liverpool, Chicago, Buda-Pesth, and other places, scores of millions of passengers per annum are being carried safely, speedily, and conveniently by electric energy. At Baltimore goods trains of 1500 tons are being hauled over very heavy gradients by the same force. Tens of millions of pounds are being spent in the construction of electric railways in London, Paris, Berlin, and other great cities. The conversion from steam to electricity of the underground lines in London, and of the elevated lines in New York, is practically settled, while in Chicago the work is already done. Ten years hence it will probably be quite the exception to find a steam locomotive employed in urban or suburban passenger service. But, as far as can be judged at present, the employment of electricity in ordinary medium or long-distance railway service, either for passengers or goods, is not likely to come within the range of practical politics just yet. 1899.]

The aerial steam carriage, a most formidable affair, with a frame 150 feet long by 30 feet wide, covered with silk, and a tail 50 feet in addition, went so far as to get itself patented. "We learn from those who have seen it," writes the *Spectator*, "that the Pegasus is actually in being. Its form has been delineated, and, if correctly, bold must be the man who will venture astride. With body stretching for many a yard, with tail lifted far aloft, with wings of copper like revolving shields, and with fire and smoke issuing from its head, no griffin it was the lot of St. George to encounter ever

presented form so vast and terrible." This fire-breathing monster (so Samuel Rogers said) only resembled a bird in one respect—it had a *bill* in Parliament, presented by the honourable and learned member for the city of Bath. On one occasion, however, in the lively imagination of a writer in the *Glasgow Constitutional*, who succeeded in hoaxing several of its English contemporaries, it had a most prosperous trial trip.

The locomotive had, however, more serious competitors than these. The London and Blackwall Railway was worked by stationary engines, dragging the carriages with one wire rope for the up and another for the down traffic, each having a total length of about 8 miles and a weight of 40 tons. And on this line, among the first, the electric telegraph was used, in order that the engineer at Blackwall or Fenchurch Street might know when to begin to wind up or let go his rope. The system in use was certainly most ingenious. A down train, as it left Fenchurch Street, consisted of seven carriages. The two in front went through to Blackwall; the next carriage only as far as Poplar, and so on to the seventh, which was detached at Shadwell, the first station after leaving Fenchurch Street. As the train approached Shadwell, the guard, standing on a platform in front of the carriage, pulled out "a pin from the coupling at an interval of time sufficient to let the carriage arrive at its proper destination by the momentum acquired in its passage from London." The same process was repeated at each subsequent station, till finally the two remaining carriages ran up the terminal incline, and were brought to a stand at the Blackwall Station. On the return journey the carriage at each station was attached to the rope at a fixed hour, and then the whole series were set in motion simultaneously, so that they arrived at Fenchurch Street at "intervals proportioned to the distance between the stations." On the up journey the Blackwall portion of the train consisted of four carriages, there being, so to speak, a "slip-coach" for Stepney and another for Shadwell, and this seems to have

been the nearest, and in fact the only, approach to an attempt to deal with traffic between intermediate stations. But the wear and tear was too much; there were perpetual delays, owing to the rope breaking, and the cost of repairs and renewals was something immense.

The Sunderland and Durham also was worked with a rope, at first of hemp and afterwards of wire, as was and still is the Cowlairs tunnel on the Edinburgh and Glasgow line. On other similar local lines, such as the Edinburgh and Dalkeith, or the Dundee and Arbroath, the carriages were still drawn by horses. In Ireland, again, the continuation of the Dublin and Kingstown Railway on to Dalkey, which was worked by atmospheric engines, was just being opened for traffic, a speed of about 30 miles an hour having been successfully obtained on several trial trips. It was proposed to work the line from Exeter to Plymouth by water power. Water power, however, was abandoned, and the atmospheric system adopted, and this was so far at least a success, that on one occasion the 8 miles between Exeter and Starcross were said to have been covered at the rate of 70 miles an hour. An American inventor, Mr. Bissell, had constructed a pneumatic locomotive, to be driven by compressed air stored in reservoirs at a pressure of 2000 lbs. to the square inch.

Even where steam locomotives were employed, "the slowness to believe in the capabilities of the locomotive engine exhibited by the engineers of Great Britain is" (the quotation comes from the *Athenæum* of April 22nd, 1843) "surprising . . . . Want of faith in the capabilities of the locomotive engine has formed one important item in the cost of the English railway system. Engineers set out in their railway career with the impression that the locomotive was ill calculated to climb uphill with its load, and that therefore, to work with advantage, it must work on lines altogether level, or nearly so; hence mountains required to be levelled, valleys filled up, tunnels pierced through rocks, and viaducts reared in the air,—gigantic works at a gigantic cost, all

for the purpose of enabling the engine to travel along a dead level, or nearly so. But here, again, was want of faith in the power of the locomotive engine. The locomotive engine can climb the mountain-side as well as career along the plain." So wrote the *Athenæum* in 1843, and so, in fact, it was proved in the next few years, when the Lancaster and Carlisle was carried over Shap Fell at a height of 915 feet above the sea, with a gradient of 1 in 75 for 4 miles, and the Caledonian climbed for 10 miles at a gradient of 1 in 80 to Beattock Summit, 1015 feet above sea-level.

Still, even as early as this time, when trains out of Euston and Lime Street, Liverpool, were hauled up by stationary engines, and the up trains through the Box Tunnel were assisted by a second engine behind, there were some lines where locomotives had every day the opportunity of showing that they could "climb the mountain-side." Here is the *Durham Advertiser's* account of the matter: "Let those who are sceptical as to the practicability of constructing a railway *to profit* over a hilly country, without encountering the enormous cost of securing what are called 'easy gradients,' visit the Hartlepool Railway, where they will find a locomotive engine with its tender pulling a train of three or four passenger carriages up a short inclined plane of 1 in 30 and two long inclined planes of 1 in 35, at velocities of from 20 to 25 miles per hour, four times in the day; and the only obstacle to its ascent (with still greater weights) appears to arise from the slipping of the wheels, or their want of adhesion to the rails in wet weather. This engine is furnished with 14-inch cylinders and six 4½-feet wheels coupled together. Who, then, shall venture to assert that railways will not hereafter be laid over the rough surface of any country hitherto deemed inaccessible by them? If the [illegible] or tire of the wheels of such a locomotive were considered [illegible] widened, and the main rails upon such inclined planes [illegible] upon longitudinal sleepers and"—here comes in the curse [illegible] lack of faith that the *Athenæum* so justly reprobates ...

extra rail of wood or rough—why not cogged?—iron fixed outside the main rail, to which the tire of the engine (but not the carriages) wheels should extend, their adhesive power, we imagine, might be doubled. . . . 'Nil mortalibus arduum est,' we exclaimed whilst flying up one of those Hartlepool inclined planes last week." *

But, though the *Athenæum* said truly that the monumental lines of Stephenson and Brunel ought never to have been built in the style they were for the traffic of 1843, time has proved that, after all, the engineers were right, though they did not know it, and the philosophers were wrong. For to its splendidly straight and level track the North Western owes it that it can with ease keep abreast of the utmost efforts of its energetic rivals, the Great Northern and the Midland, in the race to Manchester; while the Great Western finds in the same circumstance ample compensation for the fact that its line to Exeter is no less than 23 miles further than the rival route. Meanwhile, the day of monumental lines was over, and the projectors of new routes were being compelled by the prevailing depression to cut their coats according to their cloth, and content themselves with schemes much more moderate than those with which they would have been satisfied a few years before. Unconvinced, however, that locomotives could climb gradients, they were still in search of contrivances scarcely less impracticable than the cogged wheels and movable legs of an earlier generation, in order to overcome their imaginary difficulties. One ingenious gentleman went so far as to suggest that, though the engine should have wheels to keep it on the line, the weight should be carried, and the driving power should be applied to rough rollers running upon a gravel road, maintained at a proper level between the two rails. By this method alone, he was convinced, would sufficient bite of the ground be obtained to enable a locomotive to draw a paying load up an incline.

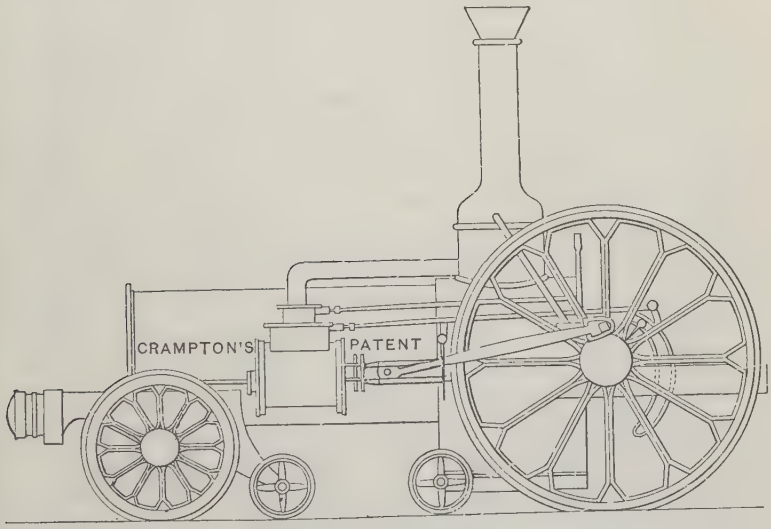
* Of the Lickey incline, on the Birmingham and Gloucester, which was opened in 1840—1 in 37 for 2 miles—I shall have something to say in the chapter on the Midland Railway.

Another engineer proposed that on gradients steeper than 1 in 100 a second rail should be introduced, inside the ordinary one, on which the flange of the driving wheels, specially made rough for this purpose, might bite more firmly.

On the other hand, Lieutenant Le Count, R.E., of the London and Birmingham Railway, whose book is a mine of information in ancient history, writes as follows: "The want of adhesion, so much talked of, is found to be only nonsense, and, if there had been any, it would only be necessary, as the writer of this article suggested several years ago, to connect a galvanised magnet with one or more of the axles to act on the rails, by which means, with the addition of only a few pounds, an adhesion equivalent to the weight of two tons would be produced at each axle, being capable also of acting or not at a moment's notice." Lieutenant Le Count was sceptical on another point also. The puny little 'Goliaths' and 'Samsons,' with a boiler pressure of some 40 lb. as against the 140 to 180 lb. of to-day, were sometimes brought to a standstill by a fall of snow. But "the plans so often proposed," he writes, "of sweeping or scraping the rails will rarely be found necessary, much less the plan, seriously proposed and patented so late as 1831, of making the rails hollow and filling them with hot water in winter."

The tentative condition of the engineering knowledge of the time cannot be better exemplified than by a glance at a sketch furnished to the *Railway Times* in January, 1843, by an engineer as distinguished as Mr. Crampton. This sketch, which is reproduced opposite, "shows safety or reserve wheels not running upon the rails while the engine is ordinarily at work, and not therefore liable to suffer. They are provided with deep flanches (*sic*), which act as a guide for the engine in the event of accidents . . . . It will be obvious," writes Mr. Crampton, "that, should either axle break, the weight would be immediately supported by the reserve wheels, and the safety of the engine ensured." But there was another advantage, Mr. Crampton thought: "By this arrangement I am enabled to place the boiler considerably

lower than in the engines commonly used, which allows the use of much larger driving wheels, without endangering the safety of the engine, and also reduces the rocking and pitching motion to which engines having the centre of gravity placed high are continually subject." Such was the universally accepted ancient theory, a theory which probably accounted for Mr. Harrison's patent of 1837, as to which I



"CRAMPTON'S PATENT."

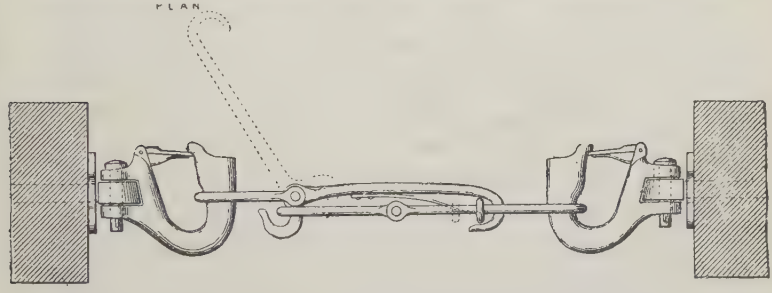
shall have something to say in the chapter on the Great Western Railway, and which certainly in 1847 led to Mr. Trevithick building the famous old 'Cornwall' with her boiler beneath the driving axle. Modern practice, however, has shown that engines with a high centre of gravity not only run more smoothly and are less hard upon the permanent way, but actually are safer in running round sharp curves at a high rate of speed.

Still, in spite of all these difficulties and hesitations, railways were steadily taking more and more hold of the public

life and habits. In February, 1842, the *Morning Post* writes: "It is worthy of remark that Her Majesty never travels by railway. Prince Albert almost invariably accompanies the Queen, but patronises the Great Western generally when compelled to come up from Windsor alone. The Prince, however, has been known to say, 'Not quite so fast next time, Mr. Conductor, if you please.'" His Royal Highness must have got pretty rapidly acclimatised, as in July, 1843, he came up from Clifton to Paddington within three hours. The Queen herself could not hold out much longer, and on June 18th, 1842, the *Railway Times* records: "Her Majesty made her first railway trip on Monday last on the Great Western Railway, and we have no doubt will in future patronise the line as extensively as does her Royal Consort. The Queen Dowager, it is well known, is a frequent passenger by the London and Birmingham Railway, and has more than once testified her extreme satisfaction with the arrangements of the Company. On Wednesday last Her Majesty Queen Adelaide went down by the South Western Railway for the first time *en route* for the Isle of Wight." Her Majesty returned a few days afterwards, and accomplished the 78 miles between Southampton and Vauxhall in one minute under the two hours—a run of which the South Western authorities were evidently not a little proud. And one must admit that they had a right to be so. It was not till July, 1888, that the present generation had a chance of getting to Southampton in so short a time. Not long afterwards, however, another "special" ran the distance in one hour and forty-six minutes. But the run must have been a pretty rough one, with little four-wheeled carriages loosely fastened together with couplings such as the one figured opposite.

Queen Victoria apparently found a railway journey not as bad as she had fancied it, as on Saturday, July 23rd, she returned from London to Slough by the Great Western, "accompanied by his Royal Highness Prince Albert, their Serene Highnesses the Prince and Princess of Saxe Coburg Gotha, and a numerous suite." The Duke of Wellington

took even longer to convert. It was not till August, 1843, that, being then in attendance on the Queen, he was compelled to take his first trip by rail to Southampton. On this occasion there were, it is reported, "the unprecedented number of eight specials (four each way) in addition to the ordinary traffic, twenty-seven trains in the day, including goods trains." Six weeks later there is this note: "We are glad to find that the Duke of Wellington's first trip on the South Western Railway, in attendance on Her Majesty, has reconciled his Grace to the new mode of travelling. Last



DRAW LINK EMPLOYED ON THE SOUTHAMPTON RAILWAY.

week his Grace passed from and to Folkestone in one day by the Dover line."

But trains were not good enough even yet for foreign royalties. As late as July, 1843, the *Globe* translates from the French journal *Le Commerce* the following story of Louis Philippe:—"When the King was intending to go with the Royal Family to his château at Bizy, he proposed to be conveyed by a special train on the railway as far as Rouen, and orders were given to this effect; but the Council of Ministers, on being acquainted with His Majesty's project, held a sitting, and came to the resolution that this mode of travelling by railway was not sufficiently secure to admit of its being used by the King, and consequently His Majesty went to Bizy with post-horses. This, it must be acknowledged, is a singular mode chosen by the Cabinet for encouraging railways." No doubt the frightful Versailles

accident of the year before, in which fifty passengers were burnt to death, had something to do with this decision of His Majesty's ministers. It certainly gave rise to Sydney Smith's celebrated letter as to the necessity of sacrificing a bishop to secure the doors of the carriages being left unlocked. A correspondent of the newspapers, however, persisted that, "in spite of Socrateses, Solons, and Sydney Smiths, wise in their own conceit," locking in was right, while a second considered that the letter "showed a good deal of apparent prejudice and something of irreverent and inappropriate wit, unbecoming a Christian minister." About the same time it is recorded that the Judges, sent down as a Special Commission to try some rioters at Stafford, went by special train from Euston. "It would appear, therefore," says the *Railway Times*, "that travelling by railway is not now considered beneath the dignity of the profession." On the other hand, Lord Abinger, presiding in the Court of Exchequer, said, "It would be a great tyranny if the Court were to lay down that a witness should only travel by railway. If he were a witness, in the present state of railways, he should refuse to come by such a conveyance."

Perhaps Lord Abinger and Louis Philippe's ministers might be forgiven if they were disinclined to accept "the present state of railways" as altogether satisfactory. Here is what Mr. Bourne, a professed panegyrist of the new system, describes as a typical experience as late as the beginning of 1846: "It requires perhaps some boldness to claim for a mere piece of machinery, a combination of wheels and pistons, familiar to us by frequent use, any alliance with the sublime. Let the reader, however, place himself in imagination upon the margin of one of those broad dales of England, such for example as that of Barnsley in Yorkshire, of Stafford, or the vale of Berks, up each of which a great passenger railway is carried, and over which the eye commands an extended view. In the extreme distance a white line of cloud appears to rise from the ground, and gradually passes away into the atmosphere. Soon a light murmur falls upon the ear, and the

glitter of polished metal appears from time to time among the trees. The murmur soon becomes deeper and more tremulous. The cloud rises of a more fleecy whiteness, and its conversion into the transparent air is more evident. The train rushes on; the bright engine rolls into full view; now crossing the broad river, now threading the various bendings of the railway, followed by its dark serpent-like body. The character of the sound is changed. The pleasant murmur becomes a deep intermitting boom, the clank of chains and carriage-fastenings is heard, and the train rolls along the rails with a resonance like thunder.

"Suddenly a wagon stands in the way, or a plank, it may be, has been left across the rails; a shrill, unearthly scream issues from the engine, piercing the ears of the offending workmen, and scarcely less alarming the innocent passengers. Many a foolish head is popped out of the window, guards and brakesmen busily apply their drags, and the driver reverses the machinery of his engine, and exerts its utmost force, though in vain, to stop the motion. The whole mass fairly slides upon the rail with the momentum due to some sixty or seventy tons. Then comes the moment of suspense, when nothing remains to be done, and it is uncertain whether the obstacle will be removed in time. It is so; and the huge mass slides by with scarcely an inch to spare. Off go the brakes, round fly the wheels, the steam is again turned on, and the train rolls forward at its wonted speed, until smoothly and silently it glides into the appointed stopping-place. Then come the opening of doors, and the bustle of luggage-porters. Coaches, cabs, omnibuses, vehicles of every description, fill and rapidly drive off, until before ten minutes have elapsed the uncouth engine has slunk back into its house, and some hundred passengers, with their luggage, have disappeared like a dream, and the platform is once more left to silence and solitude."

Queen and Judges could please themselves as to whether they went by train or not. But for the mass of Her Majesty's subjects it was fast becoming a case of Hobson's

choice. The "highways were unoccupied." The turnpike tolls from Swindon to Christian Malford in Wilts, which had been let at £1992 in 1841, only produced £654 in 1842. For the tolls on the road between Wakefield and Sheffield not a single tender was sent in, and the trustees were compelled to collect them themselves. The forty coaches which had run daily through Northampton were all dead within six months of the opening of the London and Birmingham. Almost every week came a notice that some famous line of coaches had ceased to run. Here is one under date October 15th, 1842: "A few years since 94 coaches used to pass through St. Albans daily. On Saturday last the Leeds express, formerly called the 'Sleepy Leeds,' which has been on the road upwards of a hundred years, ceased running, it being no longer a profitable speculation, and it is said another out of the four remaining is likely soon to follow the example." Six weeks later we read, "The mail from Worcester to Ludlow, after running for half a century, made its last journey on Tuesday, November 29th, thus leaving the public without official conveyance for letters from Worcester to Tenbury."

Another day the papers record the death of the *Peak Ranger*, "which had stood high in the estimation of the public," on the road between Sheffield and Manchester. "On Saturday last, when drawing near to Sheffield, its inevitable dissolution became apparent, and Mr. Clark, who was driving, almost despaired of reaching the terminus before death put a period to its existence; fortunately, however, the task was accomplished, and a few minutes after its arrival it quietly departed this life without a struggle or a groan. Report says that its remains are about to be sent by railway to the British Museum in London, where it will be exhibited as a relic of antiquity for centuries to come. Unfortunately for the coachman, he was, owing to this dreadful calamity, left at Sheffield, a distance of 24 miles from home. Every inquiry was made for a vehicle to convey him home. The Leeds Railway was recommended, but this he rejected in terms of bitter resentment, when fortunately it was discovered that

one solitary wagon was still permitted to travel on that road. Having been snugly packed in the tail of the wagon, he was safely delivered at his own door within twenty-four hours after the fatal catastrophe."

Here is a similar obituary notice dated July 18th, 1843: "Died, after a long and protracted existence, the near leader of the 'Red Rover,' the last of the London and Southampton coaches. The symptoms of decay, which ended in the event we now record, set in on the day the South Western Railway opened, the severe grief produced by which brought on an affection of the heart, which, acting upon a frame not of the strongest, induced the calamity so much deplored by the inconsolable proprietors. The fact became known on Monday last, the previous four-in-hand having dwindled that morning to three. The physician who has attended the case has given his opinion that change of air is immediately necessary to save the remaining portion of this 'Red Rover' family. It would macadamise the whole of the city stones to witness the disconsolate appearance of the solitary leader. Certainly steam has much indeed to answer for!"

And here yet another from the Eastern counties:—"The days, nay, the very nights, of those who have so long *reined* supreme over the 'Phenomena' and 'Defiances,' the 'Stars' and the 'Blues,' the 'Flys' and the 'Quicksilvers,' of the Essex Road, are at an end. Their final way-bill is made up. It is 'positively their last appearance on this last stage.' This week they have been unceremoniously pushed from their boxes by an inanimate thing of vapour and flywheels, by a meddling fellow in a clean white jacket, and a face not ditto to match, who, mounted on the engine platform, has for some weeks been flourishing a red-hot poker over their heads in triumph at their discomfiture and downfall; and the turnpike road, shorn of its gayest glories, is desolate and lone. The coachmen, no doubt, 'hold it hard,' after having so often 'pulled up,' to be thus pulled down from their high eminences, and compelled to sink into mere landlords of hotels, farmers, or private gentlemen. Yet so it is. They

are 'regularly booked'—'their places are taken' by one who shows no disposition to make room for them, even their coaches are already beginning to crumble into things that have been; and their bodies—we mean their coach-bodies—are being seized upon by rural-loving folk for the vulgar purpose of summer-houses. But a few days, and they will all vanish,—

> "'And, like the baseless fabric of a vision,
> Leave not a *trace* behind';

no, not even a buckle, or an inch of whipcord; and if some years hence a petrified whipple-tree or a skeleton of a coachman should be turned up 'in digging the foundations of a closet,' they will be hung up side by side with rusty armour and the geological gleanings of our antediluvian ancestors."

In March, 1842, a few weeks after the opening of the Edinburgh and Glasgow Railway, the *Glasgow Courier* reports: "The whole of the stage coaches from Glasgow and Edinburgh are now off the road, with the exception of the six o'clock morning coach, which is kept running in consequence of its carrying the mail-bags." For Lord Lowther, the then Postmaster-General, seems to have thought, like Louis Philippe's ministers, that railways were not safe enough to be entrusted with Her Majesty's mails, and the papers are full of complaints that sufficient advantage is not taken of the rapidity of railway communication in the conveyance of letters. The Brighton coaches having been driven off the road by the opening of the railway in 1841, the mails were sent down from London in a cart, in spite of an indignant memorial from Brighton residents, who protested that such a mode of conveyance was "neither safe nor respectable." Next year, however, the Brighton Railway Company raised its fares, and encouraged some coaches to enter again upon the unequal struggle. And something similar happened on the road from Liverpool to Warrington and from Liverpool to St. Helen's.

In May, 1843, the battle in the Home Counties was so far

decided that a newspaper reports: "Only eleven mail coaches now leave London daily for the country. A few years since, before railways were formed, there were nearly eighty that used to leave the General Post Office." Even when the coaches had not been driven off the road altogether, they had been forced in many places to lower their fares. The fares from London to Birmingham had been 50*s.* in and 30*s.* outside. The opening of the railway brought them down to 30*s.* and 17*s.* respectively. Though there was no railway nearer than the Southampton line, the outside fare from Salisbury to London had already come down from 20*s.* to 13*s.* *Punch*, taking as usual the popular view, declared that the only thing left for the stage proprietors was to emigrate to "Coachin-China." In fact, however, Lord Hardwicke, in advocating the construction of a new line in Cambridgeshire, brought forward the returns of turnpike receipts—in the neighbourhood, one must presume, of the great towns—and post-horse duty, to show that the increase of short-distance and cross-country traffic had more than counterbalanced the diminution on the great main roads.

Everyone has heard of the 2000 post-horses that used to be kept in the inns at Hounslow. As early as April, 1842, a daily paper reports: "At the formerly flourishing village of Hounslow, so great is now the general depreciation of property on account of the transfer of traffic to the railway, that at one of the chief inns is an inscription, 'New milk and cream sold here'; while another announces the profession of the chief occupier as 'mending boots and shoes.'" "Maidenhead," writes an Old Roadster, "is now in miserable plight. The glories of 'The Bear,' where a good twenty minutes were allowed to the traveller to stow away some three or four shillings' worth of boiled fowls and ham to support his inward man during the night, are fast fading away for ever. This celebrated hostelry is about to be permanently closed as a public inn." Here is a yet more important effect of railways, according to the *Berks Chronicle*: "The heath and birch-broom trade, which used

to be of very considerable extent at Reading Michaelmas Fair, and from which many of the industrious poor profited, has fallen away to a mere nothing. When the dairymen had their cheese brought up the old road they used to load the wagons home with brooms; but now, since the mode of conveyance is changed to the railway, it does not answer the purpose of the dealers to pay the carriage for them by that mode of transit."

Nor were coachmen, innkeepers, and broom-cutters the only people who suffered from the change. The shopkeepers of Ashton-under-Lyne, Stockport, and other small towns round Manchester complained bitterly that their customers all went into Manchester to shop, and that they were left to sit idle. Canals had in some places fared no better. By the opening of the Manchester and Leeds line the value of the Rochdale Canal shares came down in two years from £150 to £40. The shares of the Calder and Hebble Navigation had been worth 500 guineas; they were now being freely offered at about £180.

On the other hand, new trades were springing up on all sides. One day it is recorded in a Liverpool paper that a Cheshire farmer has ceased to make cheese, and is supplying the Liverpool market with fresh milk, "conveying this nutritious article from a distance of over 43 miles, and delivering the same by half-past eight in the morning." Another day readers are startled to learn that wet fish from the East coast ports can be delivered fresh in Birmingham or Derby. A tenant on the Holkham estate bears witness to the advantage of a railway to the Norfolk farmers. His fat cattle, so he said, used to be driven up to London by road. They were a fortnight on the journey, and when they reached Smithfield had lost three guineas in value, besides all the cost out of pocket. As soon as the Eastern Counties line was opened he would send his cattle through by train in twelve hours. The farmers, in fact, seem to have taken kindly to the new order of things. For the great Christmas cattle market in 1843 the London and Birmingham brought

up in two days 263 wagons, containing 1085 oxen, 1420 sheep, and 93 pigs.

A good many of the notices remind us that the experience of the last few years is not the first revolution that the English agricultural interest has encountered and survived. Under the heading, "A New Trade in Darlington," the *Great Northern Advertiser* chronicles: "During the past month [November, 1843] vast numbers of sheep have been slaughtered by the Darlington butchers, and have been sent *per* railway to London." Here is a second from the same neighbourhood: "The 'Butter Wives' frequenting Barnard Castle market were not a little surprised on Wednesday se'nnight to discover that, through the facilities offered by the railways, a London dealer had been induced to buy butter in their market for the supply of the cockneys, and in consequence the price went up 2*d.* per pound immediately. This rise, however, did not deter the agent from purchasing, and 2000 pounds of butter were quickly bought, sold, and packed off for the great Metropolis, where it would again be exhibited, and sold to the London retailers by five o'clock on Friday morning." And here is the result: "At a meeting of the Statistical Society a paper was read on the agricultural prices of the parishes of Middlesex. . . . . The writer proceeded to say that the railway had greatly affected prices in the cattle market at Southall, and had occasioned much discontent among the farmers, who complained that, in consequence of the facility that it afforded for the rapid transfer of stock from one county to another, they had been deprived of the advantages which they formerly possessed from their proximity to London. Five hundred head of sheep and 100 head of cattle had upon more than one occasion been suddenly introduced into the market from the West of England, and prices had been proportionably forced down."

But, as a rule, on the great through lines, in 1843, everything except passenger traffic was a very secondary affair. The Great Western was earning £13,000 a week from passengers and only £3000 from goods. On the London and Birmingham

the goods receipts were much the same, but the passengers returned some £15,000. On this latter line, for the first five months of its existence, the passenger receipts were about £130,000, while the total goods earnings were £2225 9*s.* 3*d.* On the South Western the proportion was six to one; on the Brighton more than seven to one; on the South Eastern more than ten to one. Even on the Midland Counties and North Midland, where nowadays passengers are far less important than goods and minerals, five-eighths of the whole receipts came from the "coaching" traffic. Of course there were exceptions; on a purely mineral line, such as the Taff Vale, the goods receipts were five-sixths of the total, while on the Newcastle and Carlisle they were two-thirds. Still, taking England as a whole, the goods traffic was only about a quarter of the total, instead of more than half, as it is to-day. But the Great Western Railway is reported to be making arrangements to bring up Bath stone in large quantities from the quarries at Box, and the carriage of coal to London by rail had already begun. As early as 1838 a Select Committee of the House of Commons had only failed by one vote to adopt the recommendation of Lord Granville Somerset that the coal dues should be discontinued. The majority against their abolition was composed, according to the *Railway Times*, of two aldermen of the City of London, three coal-owners, and one coal-factor. In those days, however, the Metropolitan Board of Works as yet was not; the Corporation took the whole of the dues, and was under no obligation to spend them upon Metropolitan improvements.

The express and through trains on the great lines, such as the Great Western or the London and Birmingham, were timed to run at something between 20 and 30 miles an hour. From London to Bristol, for example, 118 miles, the train took four hours and a quarter, the same time that the 'Dutchman' now takes to reach Exeter, 76 miles further.* The 6 A.M. from Euston, described as "a quick train throughout,"

* [The 'Cornishman' now reaches Exeter in under three hours and three-quarters. 1899.]

reached Liverpool, *viâ* Birmingham and Newton Junction (210 miles), at 4 P.M., and Darlington, *viâ* Derby and York, at 7 P.M. It was thought a great feat that the *Times*, on one occasion when it contained important news just arrived by the Indian Mail, was delivered in Liverpool to catch the American packet at 2.15 P.M., having been sent forward from Birmingham on a special engine. Shortly after, however, the incoming mail was sent up to London in six hours and three-quarters. The *Newcastle Courant* chronicles, as "a remarkable proof of the wonders of steam travelling," that Lord Palmerston's mare Iliona ran at Newcastle on Wednesday, and at Winchester on Friday. "The distance thus travelled was nearly 400 miles, and the time 32½ hours, of which between nine and ten were spent in London." Here is a somewhat similar notice, heading and all, from the *Mechanics' Magazine* in January, 1842: "ALL-TRIUMPHANT STEAM.—The 'Great Western' fired her signal of arrival in Kingroad (10 miles from Bristol at the mouth of the river) at half-past ten on Monday night, in thirteen days only from New York. The reporter of the *Times* went on board, and left her again in an open boat and in a gale of wind before eleven. He reached London by the mail train at half-past five. The intelligence was printed and despatched again to Bristol by one of the regular trains, and a copy of the *Times* was in the cabin of the 'Great Western,' in the roadstead, by 10 o'clock P.M. These are the wonders of steam navigation, steam travelling, and steam printing."

But these times would have been much faster had it not been for the long and frequent stoppages. There was a stoppage for refreshments at Wolverton, half-way from London to Birmingham, and another at Falkirk, on the 47-mile journey between Edinburgh and Glasgow. When they were actually in motion, trains could go fast enough. We have already mentioned a run from Southampton to London at the rate of over 43 miles an hour. A special run from Liverpool to Birmingham with American despatches, 97 miles in 150 minutes, was scarcely slower, and the Grand

Junction was a line more famed for dividends than for speed. Lord Eglinton's trainer, in order to be in time for a race, took a "special" from Manchester to Liverpool, 30 miles in 40 minutes, or at the rate of 45 miles an hour. Another "special" ran from Derby, 40 miles in 66 minutes, of which 16 were spent in three stoppages. A third, from Brighton to Croydon, 40 miles in 50 minutes. And there is abundant proof that the light trains of those days (two small coaches and a guard's van probably) could, if necessary, get along nearly as fast as our own ponderous expresses, which must be not unfrequently quite twenty times as heavy. Here is a table from a paper read before the Statistical Society in the spring of 1843. It may be presumed, however, that third class trains are not included in calculating the averages.

Lines on which the Trains travel at the greatest speed.

Railways.	Average speed, exclusive of stoppages.
Northern and Eastern [London to Bishop's Stortford]	36 miles per hour.
Great Western	33 " "
Newcastle and North Shields	30 " "
North Midland [Leeds to Derby]	29 " "
Birmingham and Derby	29 " "
Midland Counties [Derby to Rugby]	28 " "
Chester and Birkenhead	28 " "
London and Birmingham	27 " "
Manchester and Birmingham	25 " "

The average speed (exclusive of stoppages) on all the lines is 21½ miles an hour.

It was a not uncommon custom, if any important person missed his train, to charter a "special" and start in pursuit. With good luck he might count on overtaking a train which had only had half an hour's "law," before it had got much more than half the distance between London and Brighton. On one occasion the Secretary of the London and Greenwich Railway, having missed the train, mounted an engine, and started in such hot pursuit, that he ran into the tail carriage

with sufficient violence to break the legs of one or two passengers.

The *Edinburgh Chronicle* must take the responsibility of vouching the truth of the story that follows: "A gentleman, on urgent business in Glasgow, arrived at the Edinburgh station on Monday morning just as the 9 o'clock train had started. A special engine was engaged, and, starting at half-past 9 o'clock, overtook the train at Falkirk at 10 minutes past 10 o'clock, running the 23 miles in 40 minutes, 15 minutes of which time was occupied in stopping at three of the stations; the 23 miles were thus traversed in 25 minutes, being at the enormous speed of 55 miles in an hour." More remarkable yet is the statement of a correspondent of the *Railway Times*, who gives his name and address as "George Wall, Sheffield, 7th December, 1843": "I have frequently timed trains to 60 to 65 seconds to the mile, and on one occasion a train ran 3 miles in 53, 54, and 55 seconds respectively, giving an average of 54 seconds per mile, or $59\frac{1}{2}$ miles per hour. (*Sic* in original. In fact it is $66\frac{2}{3}$.) In this last case two other passengers marked the time, along with me, by our own watches, and we were all agreed." It perhaps helps us to understand why trains, which could travel on occasion as fast as this, were not timed faster in every-day working, to read that among the indispensable appliances on a railway were included trucks on which to convey broken-down engines, and also a suggestion that a trolley should always be attached in front of the engine, that it might be ready at hand to fetch assistance in case of a break-down.*

But high speed was impossible over any long distance except when extraordinary preparations had been made beforehand. Even three years after this time it was looked upon as a remarkable feat that Mr. Allport travelled from

* I find a contemporary allusion to a practice (described as "almost universal before the recent improvements in engine building") of putting oatmeal or bran, or, if these could not be had, horse-dung, into the boiler, in order to stop the leaking of the tubes.

Sunderland to London and back—with relays of "specials" in waiting at Darlington, York, Normanton, Derby, Rugby, and Wolverton—600 miles in 15 hours. Not only were the engines too small to run more than 20 or 30 miles without taking in water, but there were numerous spots where the permanent way was not wholly to be trusted. Here it had shown a tendency to subside, there the sides of a cutting looked like slipping. Maidenhead Bridge was said to be unsafe; if Dean Buckland could be trusted, even the Box Tunnel was not above suspicion. In the absence of all signalling, except by hand, innumerable points such as these would need that speed should be slackened.

Dean Buckland was not alone in suspecting the Box Tunnel. The public mind was so uneasy on the subject that General Pasley was sent down by the Board of Trade to make a special inspection. He reported it sound and safe, and added "that the concussion of air from the passage of the locomotive was not likely to endanger the safety of passengers" by bringing down the roof where the tunnel was cut through the live rock without the arch being bricked. No doubt the mere fact that it was a tunnel was enough to make many people suspect it. In January, 1842, the *Glasgow Argus* reported, in reference to the Cowlairs Tunnel on the Edinburgh and Glasgow, that "as the lamps, 43 in number, will be kept burning night and day during the passage of the various trains, the dull, cheerless, and to many alarming, feelings which passing through a dark tunnel usually excite will be entirely removed, the effect being little else than the passage through a somewhat narrow street. The tunnel presents a very splendid appearance, while it creates a feeling of the utmost security, although the spectator is conscious of the immense superincumbent masses of rock and other strata which are resting above him."

A year or two earlier it needed more than mere gas lights to reassure the British public. "The deafening peal of thunder," said one medical authority, "the sudden immer-

sion in gloom, and the clash of reverberated sounds in a confined space, combine to produce a momentary shudder, or idea of destruction, a thrill of annihilation." Here is what Lieutenant Le Count found it necessary to publish as to the London and Birmingham:—"So much has been said about the inconvenience and danger of tunnels, that it is necessary, whilst there are yet so many railways to be called into existence, to state that there is positively no inconvenience whatever in them, except the change from daylight to lamplight. This matter was clearly investigated and proved upon the London and Birmingham Railway, a special inspection having been there made in the Primrose Hill Tunnel by Dr. Paris and Dr. Watson, Messrs. Lawrence and Lucas, surveyors, and Mr. Phillips, lecturer on chemistry, who reported as follows: 'We, the undersigned, visited together, on the 20th of February, 1837, the tunnel now in progress under Primrose Hill, with the view of ascertaining the probable effect of such tunnels upon the health and feeling of those who may traverse them. The tunnel is carried through clay, and is laid with brickwork. Its dimensions, as described to us, are as follows: height, 22 ft.; length, 3750 ft.; width, 22 ft. It is ventilated by five shafts from 6 to 8 ft. in diameter, the depth being 35 to 55 ft.

"'The experiment was made under unfavourable circumstances; the western extremity being only partially open, the ventilation is less perfect than it will be when the work is completed; the steam of the locomotive engine was also suffered to escape for twenty minutes, while the carriages were stationary, near the end of the tunnel; even during our stay near the unfinished end of the tunnel, where the engine remained stationary, although the cloud caused by the steam was visible near the roof, the air for many feet above our heads remained clear and apparently unaffected by steam or effluvia of any kind, neither was there any damp or cold perceptible. We found the atmosphere of the tunnel dry and of an agreeable temperature, and free from smell; the lamps of the carriages were lighted, and in our transit

inwards and back again to the mouth of the tunnel the sensation experienced was precisely that of travelling in a coach by night between the walls of a narrow street; the noise did not prevent easy conversation, nor appear to be much greater in the tunnel than in the open air.

"'Judging from this experiment, and knowing the ease and certainty with which through ventilation may be effected, we are decidedly of opinion that the dangers incurred in passing through well-constructed tunnels are no greater than those incurred in ordinary travelling upon an open railway or upon a turnpike road, and that the apprehensions which have been expressed that such tunnels are likely to prove detrimental to the health, or inconvenient to the feelings of those who may go through them, are perfectly futile and groundless.'

"The above will, of course, set the question at rest, especially as the Leeds and Selby Tunnel, only 17 feet in height and 700 feet in length, is found to produce no inconvenience; and as any persons may now try the experiment themselves on longer tunnels than even that at Primrose Hill. We may instance the tunnel near Kilsby, on the London and Birmingham Railway, which is 2425 yards long, and traversed without the slightest inconvenience, or sensation of cold or damp, the change experienced being merely that from sunshine to shade, and from daylight to lamplight, and this latter only in those seasons of the year when the days are considerably longer than the nights."

The Prince Consort, too, was not the only person who protested against over-rapid travelling. The newspapers are full of complaints of dangerous speed. One correspondent suggests that notice boards shall be fixed all along the line, prescribing the due speed for each stretch, lest the engine-driver should be tempted to exceed the bounds of prudence. Another proposed to forbid all speed in excess of 20 miles an hour exclusive of stoppages, and "to insure this not being exceeded there should be a method adopted by which the engine would give notice of the same to every

passenger, that they might report upon it. I am prepared to produce a plan by which this can be effected. The whistle might be blown (*i.e.*, utter a slight sound) at every *quarter* or *half-mile*, being worked by the driving wheel. And this arrangement would be attended with another advantage, viz., in a fog. It might then sound to its full power, giving not only notice of its approach, but some idea of the speed; and, if generally understood that the whistle of the down train sounded six seconds, whilst that of the up train uttered its note only three, there would be no mistake as to which train was approaching."

Accidents were naturally of frequent occurrence, taking mainly the shape of collisions. Here, for example, is a record of a single line, the North Midland, for a single week of January, 1843, as given by a correspondent of the *Railway Times* of that date.. This company appears to have engaged several new drivers, one of whom had just been released from Wakefield Gaol, where he had served two months' imprisonment for being "in a beastly state of intoxication" when in charge of an engine. Considering the pace at which the directors seem to have used up their rolling stock, it is not a little remarkable to read in advertisements of this same date: "The stock of carriages on this railway being found to be much larger than the traffic requires, orders have been given to sell 30 first-class carriages and 30 second-class carriages":—

"*Jan. 2nd.*—No. 48 engine, sent out to bring in a broken horse-box; connecting rod broke, and that broke the cylinder cover, and otherwise seriously damaged the working gear.

"*Jan. 3rd.*—Before the goods train out of Leeds at 8 p.m. arrived at Masbro'—a distance of thirty-two miles—the driver was compelled to draw his fire out. He afterwards arrived at Derby six hours late. (This engineman only worked a stationary engine before.) The eight o'clock into Derby overtook a coal train about three miles from Derby with four engines attached to it, the gatekeeper informing the alarmed and trembling passengers that it was only a coal train that had obstructed the line for five hours. The cause of employing so many engines was that three of them were sent out as pilots, one after the other, but unfortunately got so disabled themselves that they were unable to render the necessary assistance.

"*Jan. 4th.*—No. 61 engine, running the coke train, broke down in

Killamarsh Cutting. No. 44 engine, having just undergone a thorough repair, broke one of the cylinders, and was otherwise much damaged. No. 6 engine, running the mail train, broke the connecting rod.

"*Jan. 5th.*—No. 11 engine, running the mail train out of Derby, broke down after running eight miles; with all the energy possible, it cannot be put into a proper state of repair for months. This caused a delay to the mail of two hours and twelve minutes into Leeds. No. 9 engine, damaged very much in the fire-box. The 10.15 train into Derby broke down, and was unable to proceed till the 11.15 train came and brought both trains into Derby; damage serious.

"*Jan. 6th.*—The 3.15 train out of Derby broke down and was taken into Leeds by the pilot engine; one hour fifty minutes late.

"An engine-driver (Moon is his name) proceeded immediately after a train full of passengers, overtook it, and pushed it before him just as he thought proper. The passenger train which leaves Leeds at 5.30 p.m. was standing at Barnsley Station when Edward Jenkins, driver of a luggage train, ran into it. The usual signals had been given to Jenkins, but from some cause or other were not observed. There were only three carriages in the passenger train, and fortunately only one passenger. The carriages were all smashed to pieces, and the head of the unfortunate passenger was cut completely off."

The above tale of disasters might lead us to imagine that trains seldom reached their destination in safety. But apparently we should be wrong in so thinking. In 1841 only twenty-four passengers were killed and seventy-two injured from causes beyond their own control. In 1842 the numbers were five and fourteen respectively. "These figures" (say the Board of Trade officials) "would seem to indicate that the science of locomotion has, as far as the public safety is concerned, reached a high degree of perfection; of the 18,000,000 passengers conveyed by railway in the course of the year, only one was killed while riding in the train and observing the common degree of caution." "We are satisfied that a degree of security has been attained upon well-managed railways, decidedly superior to that of any other mode of conveyance."

The truth seems to be that accidents were frequent rather than serious. Neither the companies' servants nor the public had yet learned to treat railway trains with the necessary caution. Engine-drivers fancied that a collision between two engines was much the same thing as the interlocking of the wheels of two rival stage-coaches. Passengers

tried to jump on and off trains moving at full speed with absolute recklessness. Again and again it is recorded, "injured, jumped out after his hat"; "fell off, riding on the side of a wagon"; "skull broken, riding on the top of the carriage, came in collision with a bridge"; "guard's head struck against a bridge attempting to remove a passenger who had improperly seated himself outside"; "fell out of a third-class carriage while pushing and jostling with a friend." "Of the serious accidents reported to the Board of Trade," writes one authority, "twenty-two happened to persons who jumped off when the carriages were going at speed, generally after their hats, and five persons were run over when lying either drunk or asleep upon the line." On one occasion a prisoner who was being taken by train sprang out and rolled down the embankment. The gaoler sprang after him and caught him. Both were uninjured.

And, if drivers, and guards, and passengers had scarcely learned the need of caution, still less had the brute creation. The number of "coos" that found how awkward a customer was a railway engine passes belief. Sometimes the train kept the rails, sometimes it ran off, as happened to a North Western express that was charged by a bull on the embankment near Watford. Here is one entry: "No fewer than nine hares and one dog have within the last fortnight been run down by the trains on the Birmingham and Gloucester Railway." Here, however, is a happier experience: "Upon the arrival of the 'Elk' engine at Nine Elms on Tuesday night, with the six o'clock train from Southampton, a lark was found in the ash-pan (within six inches of the fire-bars) which had received no further injury from this novel species of bird-trap than the singeing of a few tail feathers. It is now in the possession of the engine-driver and appears quite lively."* One class of accidents, which

* The lark was more fortunate than a rook which flew across the line in front of the Midland Edinburgh express a short time back. The chimney of the engine, on which I was travelling, struck him with disastrous consequences.

was far from uncommon, was that a carriage or a goods truck was set on fire by cinders from the locomotive's chimney.

Not a few of the accidents had an element of comedy in them. A man, brought up for placing an obstruction on the line, urged in his defence that "he had a right to do it, having lost his own leg in an accident two years before." Here is a story from the *Globe*: "A gentleman persisted, though advised to the contrary, in riding in his own carriage on the train to Brighton. In the Balcombe tunnel the truck, which was the last vehicle, became disengaged. The unfortunate occupant, perceiving the train leaving him, called after them, but in vain; and, finding they proceeded on their journey, he became dreadfully alarmed, being afraid to alight, and not knowing whether in a few minutes he might not be dashed to pieces by the next train. He had not been long in this suspense when an engine entered the tunnel, puffing away and the whistle screaming. He now considered his doom sealed; but the engine proved to be a pilot one sent to look after him, the truck and carriage having fortunately been missed on the train arriving at the next station. The carriage and occupant were then conveyed to Brighton, where they arrived soon after the train, and the only damage was the great fright the gentleman sustained." Of a different class was an accident at Tewkesbury: "At the top end of the station was a gateway, and beyond this a line of rails which crosses the public street and leads down to the river Severn. There was some scaffolding erected inside the gateway, which would not admit of an engine to pass under it; but on this occasion the engine proceeded at full speed through the gateway, and the scaffolding catching the chimney, down it came, crushing the gateway, and the engine getting into the street, a pig that was passing at the time was run over and killed on the spot."

Not but what serious accidents did occasionally happen. For three years the Great Western Railway had enjoyed an almost absolute immunity. Out of over three million

passengers one broken leg and several bruises was the whole of their record. On Christmas Eve, 1841, a goods train left Paddington at 4.40 A.M., consisting of an engine and tender, two third-class carriages conveying thirty-eight passengers, a luggage van, and sixteen goods wagons. All went well as far as Twyford, which was reached about 6.40 A.M. Between Twyford and Reading, in the deep Sonning cutting, the train ran into a mass of earth that had fallen on to the line and covered it to a depth of nearly 3 feet. The driver and fireman jumped off as the engine turned over, and were uninjured. The passenger carriages were dashed against the prostrate engine by the weight of the goods wagons pressing forward from behind. Eight of the occupants, "people of the poorer classes who were looking forward to a Christmas holiday with their friends in the country," were killed on the spot, while seventeen were severely injured. The Coroner's jury brought in a verdict, "Accidental death in all the cases, with a deodand of £1000 on the engine, tender, and carriages." Since Lord Campbell's Act deodands have become obsolete, and the word will probably need explanation. By the Common Law any chattel, be it a gun, or a wagon, or a savage ox, by which a man's death was caused, was *Deo dandum*, or forfeited for pious uses. In practice it was redeemed at a price fixed by the jury, and the proceeds, which were nominally forfeited to the Crown, were devoted to the benefit of the family of the deceased. In this particular case the *Standard* records as follows: "The £1000 deodand goes, by a grant made in the reign of James I., to the lord of the manor, Mr. Palmer, the member for the county. From the well-known benevolence of that gentleman, there can be but one conviction as to the mode in which the money will be applied."

At the inquest Mr. Brunel was one of the witnesses examined. Being asked why the passengers were put in front next the engine, he explained that "many accidents might arise to passengers if placed in the rear of the luggage trains by being run into, luggage trains being liable

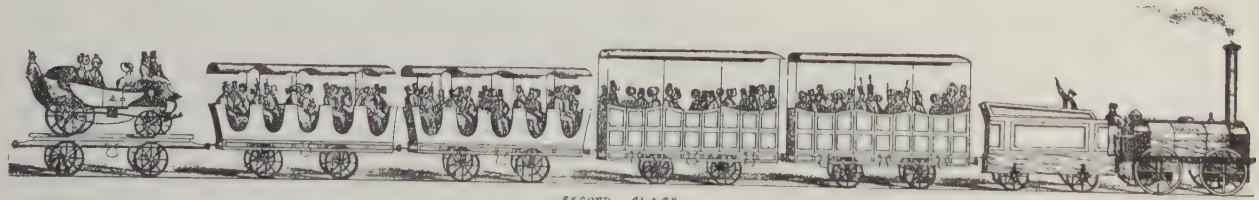
to be run into by other trains as being slower and unavoidably less punctual." Also there would, he thought, be a risk that the lamp behind might go out, and then the trucks would perhaps get uncoupled and the passengers would be left behind. By a strange coincidence, thirty-three years afterwards, another Christmas Eve saw the greatest catastrophe that ever overtook the Great Western Railway. At Shipton thirty-four passengers were killed and more than seventy injured. Again it was a third-class carriage that was wrecked, and again the third-class carriage was improperly (so the critics said) next to the engine. After the Sonning accident an empty truck or two was inserted between the engine and the passenger carriage, in order to furnish something soft to run into. And to this day, on one line at least, the North Western, it is a standing rule that, if there is no guard's van at the head of the train, at least the two front compartments shall be kept locked and unoccupied. In consequence of this same accident the conveyance of third-class passengers became the subject of a Board of Trade inquiry. It appeared that the Great Western and the South Western were the only companies that habitually attached passenger carriages to heavy luggage trains; on the Birmingham line (which even at this time ranked as the leading company) third-class passengers "are taken along with horses, cattle, and empty return wagons, but not with heavy luggage wagons."

Indeed, the luckless third-class passengers must have had a very bad time of it in the forties. The fares were not over cheap, being usually nearly and in several instances quite three-halfpence per mile, or the same as first-class fares are at present on the great northern lines. For this sum the third-class traveller was conveyed at unearthly hours in company with "horses, cattle, and empty wagons," in pens that horses and cattle would have disdained to occupy. The "large covered wagons, closed in front and with a door behind," that were supplied by the generosity

of the Birmingham and Gloucester directors, were, said a correspondent, the only ones he had seen "which afforded to the passengers that protection from the wind and weather which they had a right to expect." The carriages, as they were called, usually had no roofs, and of course no windows, the sides being only 2 or 3 feet high. The Manchester and Leeds specified for carriages to be built 3 feet in height, with an iron railing of 6 inches in addition. On one occasion the passengers profited by the openness of their carriage to warm their hands on the chimney of the engine, which was being driven tender foremost. At the urgent representation of the Board of Trade officials, the panelling at the side was increased in height, as many people had fallen out while the trains were in motion, and at a later period one company was generous enough to provide doors 4 feet high. The carriage buffers were as often as not mere solid blocks of wood. Bearing springs also were by no means always present, though Lieutenant Le Count urges that the wheels, axles, and springs should be equal to the best "as conducing to the good order of the road." As for seats, some companies provided them, others only afforded standing room. Some companies, the Edinburgh and Glasgow, for instance, and the Chester and Birkenhead, had what was practically a third-class with seats, and a fourth-class without, as is, up to the present day, the German custom. On the Greenwich line there were no seats, and one wag christened the carriages "*stantipedes*." On this the *Railway Times* remarks: "We do not feel disposed to attach much weight to the argument in favour of third-class carriages with seats. On a short line little physical inconvenience can result from their absence," and so long as no artificial inconveniences are deliberately introduced "to hurt the feelings of those who may use these inferior vehicles . . . we do not think that the public have any just ground to murmur."

The parliamentary minimum of 12 miles an hour not having yet been fixed, the speed was on a par with the

FIRST CLASS AND MAIL



SECOND CLASS

CATTLE AND GOODS

TRAINS ON THE LIVERPOOL AND MANCHESTER RAILWAY.

carriage accommodation. Third-class trains from London to Taunton took sixteen hours over the 163 miles, leaving London either at 9 P.M. or 4 A.M. When a shareholder pleaded for greater speed, he was met by the answer that passengers in third-class carriages would not be able to endure the exposure to the weather if they travelled more rapidly. To Liverpool and Manchester there was one third-class train only in the twenty-four hours, and passengers had to wait at Birmingham from 3 P.M. till 6 o'clock next morning. No wonder the Board of Trade remarks that "the advantage to the third-class passengers in point of time is often not so great as might be anticipated." No wonder also that "on the long lines, which form the main lines of communication with the Metropolis, the number of third-class passengers is inconsiderable." The Great Western carried 12,000 in six months, the London and Birmingham 24,000. Many lines, the Liverpool and Manchester, and the Newcastle and Carlisle, for instance, at this time carried no third-class passengers at all.

It is only fair, however, to remember that even to the Board of Trade it was "questionable whether the interest of the proprietors of these lines will ever lead them to encourage the development of a third-class traffic." Everything that was done was done as a concession and a favour, "for the advantage of the poorer classes," never as a matter of business in search of a profit. It should be said also that, on local lines in manufacturing districts, *e.g.*, between Sheffield and Rotherham, Leeds and Manchester, or Shields and Newcastle, quite a different state of things prevailed. Third-class passengers were not only booked by all trains, but, in one instance at least, were conveyed in covered carriages, furnished with seats. The consequence was that the Newcastle and North Shields line carried in the first six months of 1841 seven times as many third-class passengers as travelled over the whole system of the London and Birmingham and the Grand Junction put together.

But another and apparently unforeseen consequence followed, that "certain persons in superior positions" were base enough to travel in third-class carriages. If universal indignation could have crushed these miserable creatures, they would soon have succumbed: but they persevered, even in spite of the "artificial inconveniences" specially invented to deter them. Not but what these inconveniences were serious enough. The management of the Manchester and Leeds Railway adopted what was known as the "soot-bag system." Sweeps were hired to enter a third-class carriage which had been specially kept for the benefit of "persons in a superior position," and then shake out the contents of their bags. At other times, if a correspondent of the *Railway Times* can be trusted, "sheep and sometimes pigs were made the substitutes for sweeps." Even then some persons—if report said true, some bailies of the City of Glasgow—persevered in their evil courses. But their conduct evidently was strongly reprehended by all respectable persons. In describing the London and Blackwall Railway, Mr. Whishaw, the engineer, writes more in sorrow than in anger, "We were astonished to see several most respectably dressed persons riding in the Stanhope compartments, which are intended especially for those who cannot afford to pay for better accommodation." As the Company considered that "a third-class or Stanhope, 18 feet in length and 7 feet 6 inches wide," ought to hold seventy persons at least, they must be acquitted of any attempt to encourage respectable persons to derogate so far from their rightful position. Nothing perhaps could show the attitude of the public mind on this subject better than the following extract from the return made by the London and Birmingham to the Board of Trade: "The Company have erected at Roade, for the exclusive use and comfort of third-class passengers, a spacious stone building, where they may remain under shelter during the hour which they stop there and obtain suitable refreshment." Not for them was the adjacent magnificence of Wolverton with its in-

numerable pork pies. A survival of these ancient ideas may still be traced in the superstition which prevents Jeames de la Pluche from demeaning himself by travelling third-class.

Not that the second-class carriages were so markedly superior after all. Witness the following extract from the *Leeds Mercury*: "A passenger by the second-class carriages on the Manchester and Leeds complains that himself and a female relative have caught a severe cold from the holes in the floors of the carriages, which admit currents of air to the legs of passengers; he asks if there is any use or object in these holes, except to drive passengers into the first-class carriages. We cannot answer him." A correspondent of the *Glasgow Herald* says that, where everything is as admirable as on the Edinburgh and Glasgow, he hardly likes to find fault, but, if he might suggest, could not the second-class carriages have *one* side closed in? A correspondent of the *Times*, who claims to have travelled on most of the railways in England, writes: "On most lines there is a boarded partition from the top to the bottom of the carriage between each set of passengers, and the sides are partially enclosed to keep out the wind; but not so on the South Western, they seem studiously to have rendered them as bad as could be devised."

Another gentleman, who condemns the North Midland seconds as "quite dark," and those of the London and Birmingham as "abominable open" vehicles, exhorts railway managers to cross the Channel and inspect the rolling stock of the Dublin and Kingstown. Their second-class carriages are actually "not only closed in, but cushioned." Nor was the company always of the most select. Mr. Robert Ash writes that he journeyed to Manchester with two handcuffed prisoners placed by his side, and a few days afterwards on the South Western there were six convicts *en route* for transportation in the next "department." "There was one most forbidding-looking female accompanying them to see them off, but we were honoured with the gaoler's

formidable presence in our department." Mr. Ash quite admits that second-class folk must not expect much consideration, "but cannot conceive that the Company have any right to thrust such persons into the company of any honest and respectable individual, however humble may be their lot."

How second-class passengers ought to be catered for let Lieutenant Le Count testify. Here is what he writes: "The second-class should have both ends built up the requisite height, a roof put on which may be supported at each division of the body, the sides being open, or, what is perhaps still better, the sides may be made to close at nights, or in bad weather, at a slight advance in the fare. It will conduce much to the safety of those who may chance to ride on the roof of the carriage, if a netting is always hooked between each carriage, just under the footboard; at present, as the buffers are generally constructed, there is a distance of some feet between the ends of each carriage in the train, and, on any obstacle causing a concussion, those sitting with their faces towards the obstacle would be thrown under the wheels; a netting would entirely prevent this."

Even the first-class carriages were very small and cramped. A modern first-class on six wheels, with seats for twenty-four persons in four compartments, weighs four times as much as one of the original firsts with three compartments on four wheels, and allows fully three times the cubic space per passenger. Outside England, however, bigger carriages were already built. The Belgians had their queer two-decker arrangement that English tourists nowadays contemplate with amused astonishment; on the line between Leipsic and Berlin bogie carriages were already in use; while in America, almost from the very beginning, the long open cars had been universally adopted.

But imagination had already constructed carriages more convenient than the "mails" which formed the acme of then attainable luxury. Let us quote once more from our friend

Le Count, as we may be sure that his experience on the London and Birmingham placed him in the forefront of the most recent practice. "The mails should be fitted up in conjunction with the Post Office authorities. One sort of those now used are divided into two parts. The first is a sleeping-room, where two hammocks are hung up; the other is an office fitted up with drawers and pigeon-holes for the purpose of sorting the letters. Three men are employed, so that by night two are in bed, and one at work, who is in turn relieved by the others; but the nature of this service will, of course, vary with the length of journey and the quality of the correspondence. The ordinary kind of mails, which only carry the guard and the bags, without affording the means of sorting the letters, are made narrower than the other carriages in the body, and are placed on a platform over the double framing. The centre coach [*i.e.* compartment] carries four persons inside. The first coach is built as a coupee, carrying only two persons, and the hinder part will carry either four persons sitting or two lying down. The fares, of course, correspond with the accommodation. In the bed carriage it would be double, every person occupying the usual seats of two. The carriage is divided into two parts longitudinally, so that each person lying down has half the carriage to himself; but, if two persons take this half their fare should be lowered in proportion. The bed is made by placing a third cushion fixed to a board, which slides in between the two opposite seats, filling up the place where the legs of the passengers were. A door then lifts up at the back of the carriage, from the seat upwards, and fastens to the roof. This door opens into a boot which is fixed behind the mail, and into the opening go the feet of the person, the total length being about 6 feet 4 inches. A stuffed hair pillow is also provided.

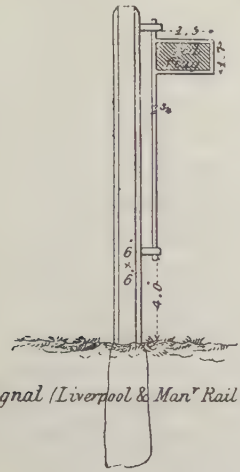
"We do not see why those who choose to pay for it could not yet have more accommodation, namely, the luxury of undressing and going really to bed, instead of lying down without taking off their clothes, the difference in comfort

between the two being so very great. All that is necessary for this purpose is to have a box containing two blankets, a pair of sheets, pillow-case, a night-cap, which could be easily stowed in the boot, and, when emptied and hung up to the roof, would form a receptacle for the passengers' clothes. There is nothing to prevent this in a practical point of view, and the advantage of such an arrangement, especially to persons in delicate health, would be so important as to fully justify the trial. In fact, carriages could easily be constructed with bed places on each side like the cribs in sailing packets, and would doubtless pay well."

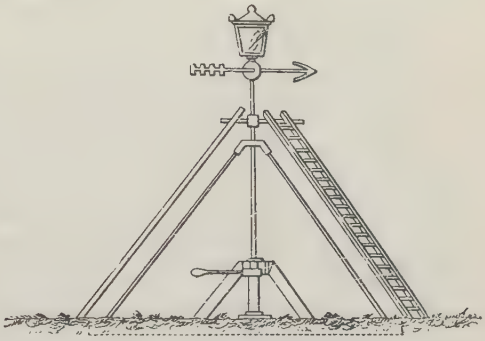
The Lieutenant's imagination, however, was not content with sleeping carriages, though, as even in America such things were scarcely heard of till well on in the fifties, his prescience was not a little remarkable. He sketched out plans for invalid carriages, lavatory compartments on ordinary carriages, refreshment carriages, with a *buffet* much like that now in use in the Pullman car on the 5 o'clock express to Brighton, and last, but not least, smoking carriages. "Smoking having now become a necessity of life to many people," he proposed to attach to a train a smoking carriage, "to be placed last except the empty carriages and horse boxes, and not communicating with the rest of the train."

But English engineers were haunted with the notion that engines could not draw larger and heavier carriages, and it was only as the small, light, four-wheeled engines gave place to larger and heavier engines on six wheels, that roomier carriages came into use. But, though the engineers hesitated to increase the size of the carriages, they had no such scruple as to the length of the trains. Here are one or two extracts from newspapers under date '42 and '43: "A few evenings ago a luggage train consisting of eighty wagons left Hull for Selby; its length was nearly half a mile." "On Thursday the 6 A.M. from Paddington to Taunton carried the immense and unprecedented number of 2115 passengers." More remarkable yet is a notice in the *Manchester Courier:*

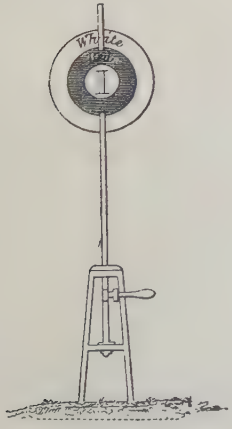
"At eight o'clock in the evening the last return train, consisting of 112 carriages, containing above three thousand persons, and extending about a quarter of a mile in length,



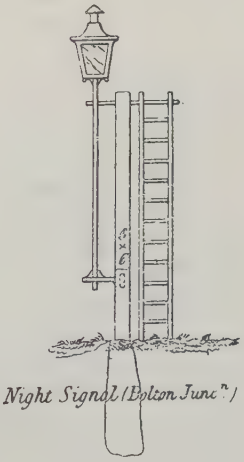
Signal (Liverpool & Manr Raily)



Night Signal (Liverpool & Manr.)



Signal (L&B.)



Night Signal (Bolton Junc.n)

left Alderley for Manchester drawn by two engines." Sometimes, when interior accommodation fell short, "the train moved off with the people clustering like bees on the roofs and platforms of the carriages." "In going back" from

seeing the Queen in Edinburgh in September, 1842, "one train took over 1500 people at once. Between carriages, wagons, etc., the train consisted of 110 vehicles filled with passengers, propelled by five engines, four in front and one behind, and the whole extended to the enormous length of nearly a third of a mile." *

The *Scottish Guardian*, which chronicles this event, adds, "We doubt very much whether a similar feat has ever been performed on any railway in the kingdom, and yet it is nothing to what might be achieved on an emergency by the London and Birmingham Railway Company, which has between 90 and 100 engines and a proportionate number of carriages." Why the London and Birmingham or any other Company should be desirous of despatching all their engines and carriages together at one fell swoop, may not seem obvious to a reader of to-day. Probably the chief reason was, that in the absence of any real system of signalling it was not safe for one train to follow another closely. Not that fixed signals were non-existent. As early as 1841 one semaphore at least was in use at New Cross. Writing in 1839, Mr. Bourne says of the London and Birmingham: "Certain policemen are stationed at intervals along the line as signalmen, whose duty it is to remove obstructions and to warn an approaching train of any obstacle to its progress. The signals made use of in the daytime are small white and red flags, and at night lanterns with lenses similarly coloured."

It is an interesting survival of this primitive state of things that, now signalmen have grown into an entirely separate class, the official who supervises them is known to railway men as a P.C. [*i.e.* police-constable] inspector. But the policeman with his flags and his lanterns could tell the

* It is worth while to contrast this with the arrangements of to-day. Messrs. Bass last summer sent a colossal excursion, 4500 of their *employés*, from Burton to Brighton, a distance of about 185 miles. The time taken on the journey was five hours, but the passengers occupied ten trains, nine of fourteen coaches each, and one of fifteen.

driver nothing till he came close to him, nor could he warrant him that the train that had passed a quarter of an hour before had not broken down just round the next corner. So the driver had to grope his way along as best he might, without even a trustworthy brake to help him. But in this very year, 1843, a paper read before the Society of Arts advocated the adoption of a continuous steam-brake. In the absence of efficient brakes, one railway in America is reported to be using sails to check the velocity of trains on steep inclines. It was not till 1848 that trains were protected by distant signals.

It should be added that, in addition to the driver and fireman, it had been proposed to have a third man on the engine, who should be supplied with a small telescope in order that he might keep a good look-out ahead; of course, the protection of a "cab" had not yet been thought of, and the men were as entirely unprotected from the weather as though they were driving, not an engine, but an old stage-coach. So too were the guards, who sat on the top of the train, the head guard on the last carriage facing forward, and the under-guard on the front carriage looking back to see that his train was duly following—a thing which it must be confessed some portion at least of the train not unfrequently failed to do. The luggage was commonly placed on the top beside them, and down to a much later period than this there were "strappers" at Euston whose special function it was to keep the straps which fastened on the luggage duly greased, lest, becoming brittle, they should break and the luggage roll off on the journey. The guards, said Lieutenant Le Count, should be furnished with wire spectacles to protect their eyes from the ashes constantly thrown out of the engine chimney till some means are found of remedying this unpleasant defect. They should by preference be old seamen, as so they will be found accustomed to lashings. They carried with them a way-bill on which the number of passengers of each class and their point of departure and their destina-

tion was duly entered by the "station clerks," *i.e.*, station masters.

Passengers who endeavoured to solace themselves on their journey with tobacco met with scant sympathy. Here is one notice: "A young barrister on the Northern Circuit, a Mr. Hay, was recently fined 20 shillings by the county magistrates at the Moot Hall, Newcastle, for smoking cigars in one of the carriages of the Newcastle and North Shields Railway Company on the preceding day." "It is right," adds the editor, "that the public should know that there is power under the Act of Parliament to punish persons who offend against good taste and propriety by smoking in railway carriages whether close or open." A foreign gentleman, writes a correspondent of the *Mechanics' Magazine*, in September, 1842, was smoking a cigar in a train coming from Brighton to London. "The guard warned him that the practice was not allowed. Nevertheless the gentleman continued to smoke, and finished his cigar. At the next station he was met by a demand for his ticket, ordered out of the *coupé*, and the guard, addressing one of the officers on the platform, warned him that 'that person was not to be allowed to proceed to London by any train that night, and there the gentleman was left." The passenger (so says the *Railway Times*, which repeats the story) "suffered most properly for persisting in violating the laws of the Company."

Even this can hardly match an occurrence that happened some years later on the Edinburgh and Glasgow line. A gentleman, well known at the time in the West of Scotland, was in a train going to Edinburgh. He smelt tobacco, and, calling the guard, complained that someone was smoking *in the train*. The guard failed, or said he failed, to find the offender, and the offensive smell continued to annoy the old gentleman. He therefore brought an action against the Company for the inconvenience to which he had been subjected, and recovered £8 6*s.* 8*d.* (£100 Scots) as damages in the Court of Session. But even at this time one English Company was complaisant enough to run a first-class

smoking carriage, under the name of "the divan," though a second refused to put on a third-class for the use of smokers who offered to pay first-class fare, and thereby forced "One who, though strictly prohibited, frequently blows a cloud on English railways," much against his conscience, "to 'tip,' as it is termed, half-a-crown to the guard, so as to change his surly 'No smoking allowed, Sir,' to a subdued whisper of 'Be kind enough, Sir, to hold your cigar down as we pass the different stations.'"

It is not difficult to find evidence that in those days the railway companies were able to treat their passengers with a rigour of discipline that would be impossible in these days of keen competition for public favour. The London and Birmingham had, we read, "upwards of 200 men, wearing a peculiar distinguishing costume, sworn in as special constables to enforce a proper attention to the rules of the establishment." Considering that guards and porters together only numbered 190, this seems a large number, even allowing for the fact that they were signalmen as well. But then the rules were both multifarious and stringent. Lap-dogs, for which the minimum charge was 10*s.*, were apt to be smuggled. People would insist on coming to see their friends off on the platform, and this was strictly forbidden, as it was also on the Great Western. A passenger, instead of walking along the train and looking for a seat, had a fixed and numbered place assigned him at the booking-office. A correspondent of the *Times* writes that, having arrived at Paddington four minutes before the time advertised for the starting of a first-class train, he was refused admission, and obliged to return home a distance of 5 miles, besides delaying an important business for two days. Another tells the same story from Brighton, with the additional aggravation that the officials acknowledged that he really would have been in time only that their clocks were wrong.

But England could not even at this period compete with the Continent in this respect. Here is an extract from

William Howitt's 'Rural and Domestic Life in Germany,' which was published in 1842: "On the railway from Vienna to Baden no tickets are given out within the quarter of an hour preceding the starting of the train. We presented ourselves at the office at Baden half an hour previous. It had begun to rain heavily, and the crowds of disappointed pleasure-seekers stood at the window waiting for tickets. Only one man delivered them; and he, with most ominous coolness, every few minutes turned his eye on the office clock. At the moment that the finger reached the quarter, he stopped, declared the time up, and refused to deliver another ticket. It was in vain that the indignant throng declared that they had already, many of them, been waiting half an hour: he only answered, 'That was the rule, he did not make it'; and the poor people must wait, not only the quarter till this train went, but another hour or two for the next. The quarter passed, and the train set out not half filled, leaving the wretched crowd in the rain! Never was the beauty of German formality so beautifully carried out. But at Berlin came the climax. At the railway office, on accompanying our luggage, a list of *five-and-twenty* regulations was put into my hand, and which now lies before me. Several of these rules consisted of two or three great sentences, and none of the clearest. There was a good hour's work to explore the whole extent of this bill of pains and penalties, to see into what liabilities you run yourself, and in default of what formalities you could not go at all. If you were sickly, you could not travel home, though it were to save your life; if you were not in your place in the carriage ten minutes before the starting time, or at the *first* ringing of the bell, you would be locked out."

One or two other miscellaneous points may be noticed. Cardboard tickets consecutively numbered had just been introduced by Mr. Edmondson; and the issue of season, or, as they are called in the North, contract tickets, was also becoming usual. Excursions at fares which were relatively cheap, though double or treble what would be charged to-

day, were becoming commoner each successive year. Railway managers were finding by experience that it conduced to good order at stations that the right to sell newspapers within their precincts should be assigned to a single respectable newsvendor. Cabs, licensed to ply for hire within the station precincts, had just been admitted to Euston Square, in spite of an attempt to crush so bold an innovation by means of an injunction from the Court of Chancery. Omnibuses between Paddington and Hatchett's Hotel—which, one is surprised to learn, had the advantage of perfect quiet because the street in front was paved with wood—were despatched at regular intervals. One reform, which was then strongly urged, has not yet been carried into effect, the establishment of a central station, probably in the neighbourhood of Smithfield, to which one or more carriages could be drawn by horses along the streets from the different termini. On the other hand, it was admitted that the erection of a bridge over the river, to connect the railways north of the Thames with those to the south, was only a question of time.

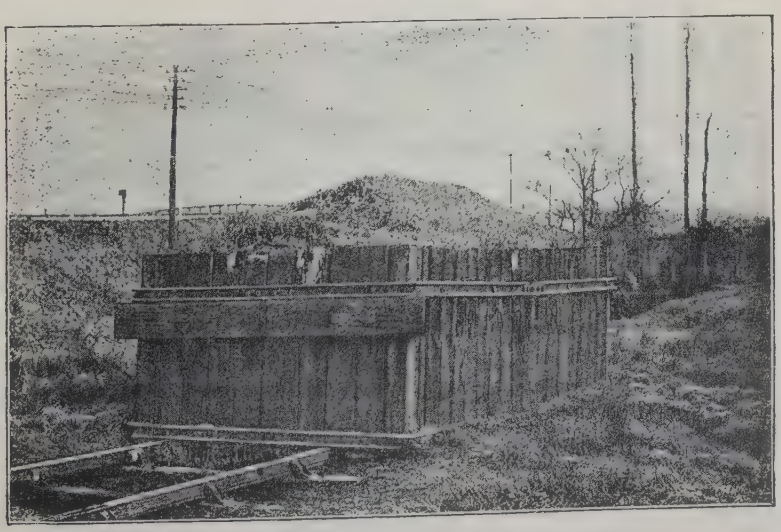
The men who in 1843 filled prominent positions in the railway world, and who still survived in 1889, can be counted on the fingers of one hand. As long ago as 1837, Mr., now Sir Daniel, Gooch had become locomotive superintendent of the Great Western. Sir James Allport had just received notice that the Birmingham and Derby Railway would be forced to dispense with his services if the amalgamation with the Midland Counties and the North Midland took effect in the following session. Mr. Samuel Laing, as Secretary of the Railway Department of the Board of Trade, was exerting himself to forge the fetters which should keep the infant Hercules within some measure of control. And last, but not least, Mr. Gladstone, who "in all matters connected with the Railway Department had proved himself laudably active and intelligent," had just been appointed President of the Board of Trade. "From his business habits and other qualifications," writes one paper, "we expect much

advantage to the public from this appointment." Nor was the expectation disappointed, for the next session saw the passage of the Cheap Trains Act.

Since 1843 many a line has made a reputation and lost it again. In those days the South Eastern was described as a "go-ahead Company," and congratulated on its "arrangements, made with consummate judgment and with due regard for the comfort of the passengers." "The carriages on the Dover line, painted a bright brown known as the Wellington brown, in fact the family colours of the Duke of Wellington, do great credit to the judgment and taste of the directors," says one writer. On the other hand, the Taff Vale, which has probably returned its ordinary shareholders dividends far larger than any other company in England, is contemptuously alluded to as "that unfortunate concern." Even in 1842, however, the London and Birmingham was recognised as the "mirror of railways," and, except in the treatment of third-class passengers, it seems well to have deserved its name. Newspaper editors and correspondents, Board of Trade inspectors, and the investing public, all rose up in turn and blessed it, its directors, and its officials. Their speed, their punctuality, their care for the interest of their *employes* at their Wolverton works, the magnificence and comfort of their station at Euston, all in turn were applauded. The £100 shares at this time stood as high as £223, and the dividend was at the rate of 10 or 12 per cent.

Such was the position of railways in 1843. In one respect, the latter year marks an innovation almost as great as railways themselves. The electric telegraph was opened between London and Slough, and with three wires it worked at the rate of thirty letters a minute. Electricians may perhaps urge that the modern 500 or 600 words a minute through a single wire represents a greater and more rapid improvement than anything railway engineering can show. But railways proper were well-nigh stationary. The companies were being urged on all hands to "close their capital

accounts." The London and Birmingham was exhorted to be content with its "enormous traffic," which had actually reached £20,000 in one single week in August. The only new lines that could be expected to pay (with the exception of the Channel Tunnel, which was strongly recommended by one enthusiastic correspondent) were agricultural lines made at a cost not exceeding £10,000 a mile, though the *Railway Times* acknowledged that, if it were possible to find such a sum of money, 2000 additional miles of line, costing probably £60,000,000, would have to be made before the railway system of the country could be looked on as complete. And yet the country was on the eve of the gigantic outburst of speculation that culminated in the great crash of 1846. George Hudson, the "Railway Napoleon"—the "Yorkshire Balloon," as another less complimentary godfather dubbed him—had just begun to attract notice, and shareholders had already been cautioned by one prescient individual to beware of raising a railway autocrat to a power greater than that of the Prime Minister. But no one yet guessed that his rise was to be so great and so rapid, or his fall so sudden and so complete.



"DEAD END"—OLD STYLE.

CHAPTER II.

THE LONDON AND NORTH WESTERN RAILWAY.

MAILS AND PASSENGERS.

"The North Western Territory extends from London in the south to Carlisle in the north, and from Cambridge in the east to Swansea and Holyhead in the west—a distance of 300 miles in length by 200 miles in breadth. There are also two small outlying dependencies on the Irish coast, the one at the mouth of the Liffey, the other in Carlingford Lough. The seat of the Government is at present in London, but the capital is Crewe, a town of 37,000 inhabitants consisting entirely of the *employés* of the Government and their families. The total number of the civil service does not fall far short of 60,000. The President is Sir Richard Moon, while his Prime Minister, who is known by the title of General Manager, is George Findlay.* The revenue of the annual budget, which last August flowed into the Exchequer at the rate of £26 a minute, amounts to £10,000,000; and the funded debt is upwards of a hundred million pounds sterling."†

It will be, we are persuaded, in some such words as these that, once the conservative mind of the British schoolmaster has awakened to the fact that counties and Lord Lieutenants are anachronisms, and that the United Kingdom has been divided and given to the great railway companies, the Board School pupil of the future will be taught his geography.

With Crewe, then, it is only right that this sketch of the North Western Railway should begin. That Crewe is the

* [Sir Richard Moon, who resigned in 1891, died as these pages were passing through the press, but Sir George Findlay died in harness six years ago. 1899.]

† [Here are the comparative figures for 1898: Total North Western servants, 78,000. Annual revenue £13,000,000. Capital, £117,000,000.]

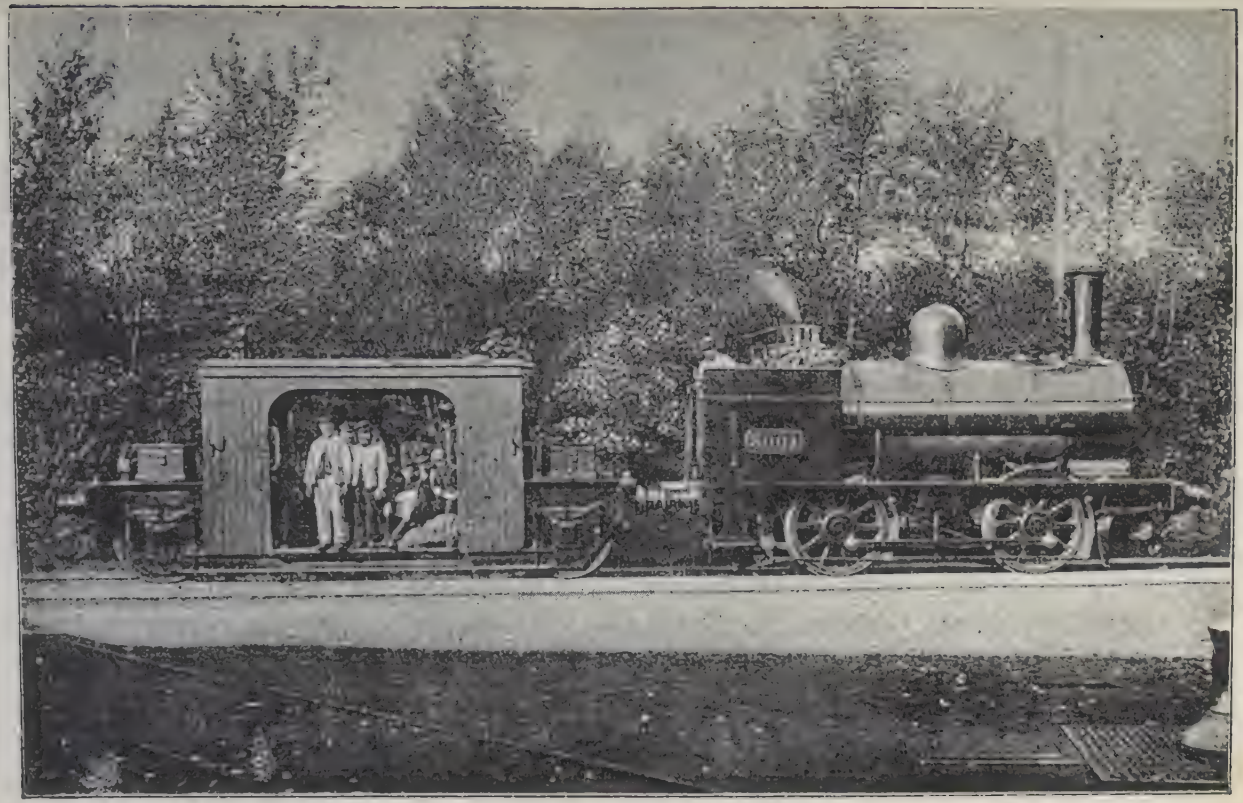
heart of the system was perhaps never more clearly shown than in July, 1887, when, in celebration of the Jubilee—not only of Her Majesty, but of the Grand Junction Railway—officials and servants assembled there from all parts of the country for a ceremony, at which Sir Richard Moon, as Chairman of the North Western Railway, presented to the citizens a public park as the gift of the Company, and the gift was received by the Company's chief mechanical engineer as the mayor of the town. On that occasion a pedestal was erected on either side of the entrance gateway. On each pedestal was a Crewe-built engine; the one was "No. 1," the other "No. 3000." The duties of the mayor, apart from his municipal functions, can hardly be a sinecure. At Crewe itself, in the "shops," there are 6000 hands under his charge, while in the carriage works at Wolverton and the wagon works at Earlstown there are not far short of as many more. The 2500 engines on the line, with, let us say, three to four men apiece as cleaners, fitters, firemen, and drivers, must also, one would think, need some supervision, to say nothing of the signals, and the pumping gear, or of the hydraulic capstans and lifts in every warehouse and goods yard all over the line.

But Mr. Webb rises above mere routine like this. Of his most important invention, the compound locomotive, we shall have more to say anon. Meanwhile let us just notice that, as we pass through the station, he points to a buffer of his design. If a train runs into what railway men term a "dead end," the injury is usually caused, not by the first shock, but by the subsequent recoil. To meet this these buffers are designed, which press not against springs, as is ordinarily the case, but against a column of soapy water stored in a cylinder under huge pressure. A shock which forces back the buffers drives the water through minute holes into an outer jacket, and thence into an air-vessel under pressure, and there is then nothing left to cause them to spring back, as the pressure of the blow gradually relaxes. A patent railway-carriage handle of his invention, enabling

the door to be opened from the inside and yet avoiding the risk that it may be opened unintentionally by children, was exhibited by Mr. Webb at the recent Manchester Exhibition. The handle is fixed almost at the top of the door frame, and when pulled downwards presses upon the spring latch of the ordinary handle and forces it back.*

From Crewe Station to Crewe Works we journey in what is termed a "cab." To an outsider there is nothing more bewildering than the habit railway men have of taking an ordinary English word and giving it some special technical sense. Most of us think we know what a bank is. To a railway man a "bank" is, in the first place, an incline, whether it be through a tunnel or over an embankment it matters not; and, secondly, a platform when used not for passengers but for goods. The "shipping" office at Broad Street Station despatches goods, not to India and China, but to Manchester, and Leeds, and Birmingham. Similarly a "cab" is primarily the screen and half-roof that protects the men on an engine from the weather. Secondly, and that is its sense here, it denotes a truck on low wheels, open at the sides, but closed at the ends and roofed over, which conveys passengers backwards and forwards along the two miles of line that intervene between Crewe Station and the furthest shop. Of these cabs there are two: the one runs at fixed times up and down again and accommodates all comers, the other runs "special" when required by any one of the principal officials. Through the shops themselves there is laid in all directions a miniature railway with a gauge of 16 inches, along which tiny engines, scarcely bigger than a large model, the 'Topsy,' the 'Nipper,' the 'Midge,' and half-a-dozen more, pant hither and thither with their mimic loads. It was with these small engines

* Most railway companies have a patent door-handle of their own. An unusually ingenious one, enabling the door to be opened from the inside, not by pressure downwards but by a pull upwards, which could hardly be applied accidentally, has recently been brought out at the Bow Works, and is now, I believe, in process of adoption on the whole of the North London rolling-stock.



A CREWE "CAB."

that the North Western a year or so back tried the experiment of towing barges on the Shropshire Union Canal.

To describe Crewe Works in detail is an obvious impossibility. The North Western Railway is a kingdom in itself, and its Government considers that it should be dependent on the outside world for as few as possible of the necessaries of life. The manager can think of nothing of importance that is imported in a manufactured state, except copper tubes for locomotive boilers. As we pass from shop to shop, here may be seen a steel canal-boat in process of construction (for the Company, it must be remembered, is a great canal proprietor); there, a lattice-work bridge is being fitted together. Further on, hydraulic pumps, cranes, and capstans crowd a huge shed. In another place chains of all sorts and sizes, from cables to harness traces, are being forged by the ton; close by, coal-scuttles and lamps are being turned out by the hundred. In all the works there is no stranger sight than a corner in the carpenter's shop, where two men are constantly employed making artificial limbs. Some two years back the Company embarked on this branch of manufacture, and undertook to supply legs and arms of the most finished workmanship to any man who lost his own in their service. The limbs turned out would do credit to one of the great London instrument-makers. Fortunately, thanks to greater care and better appliances—shunting-sticks more especially—accidents are far less frequent than they used to be, and the artificers are chiefly occupied in keeping up repairs. As corporations are commonly reputed to have no souls, it may perhaps be mentioned that, though of course there is no legal obligation on them to do so, the leading railway companies at least make it a rule to find or to create a permanent post in their employ for every old servant who has had the misfortune to be disabled in their service.

But we must not linger longer over *hors-d'œuvres* such as bridges and cables, but must get on to the *pièces de résistance.* Let us first go into the rail mill. The North Western alone among English companies rolls its own rails, and not a little

hostility it incurs (especially in times of slack trade) among the private manufacturers by doing so. There is no more interesting question in railway economies than this: "Ought a company to buy or to manufacture for itself?" The North Western, as already mentioned, manufactures for itself almost everything it needs, as does also its energetic and successful younger brother, the North London; on the other hand, the Manchester, Sheffield, and Lincolnshire, which for many years had its own steel works and rolled its own rails, has recently abolished its steel-making plant, and taken to buying in the open market. But, then, the reason given for the change was not so much that the Company could buy cheaper than they could manufacture, as that the great rail-making firms were jealous of being deprived of custom to which they considered themselves entitled, and showed their resentment by sending their goods, when possible, by rival routes. Whether for this reason, or because an ordinary line is not able fully to employ, and yet cannot afford to keep idle, the very costly plant necessary for steel rail-making, no other company at present shows any inclination to embark upon this branch of business.

But in the case of rolling-stock the position is very different. A railway is forced to provide plant and machinery in order to keep its engines and carriages in repair, and repairs not being sufficient to keep the machines employed, finds it economical to manufacture as well. A generation back almost all the new engines came from the private builders; to-day it may be roughly said that every railway company builds its own engines, and that most of them build their own carriages as well. Quite recently the Lancashire and Yorkshire and the London and South Western have definitely committed themselves to this policy, while the works at Derby and Doncaster, Swindon and Gateshead, grow steadily larger year by year. But, even so, the North Western manufacture for themselves many things that other companies are content to buy ready

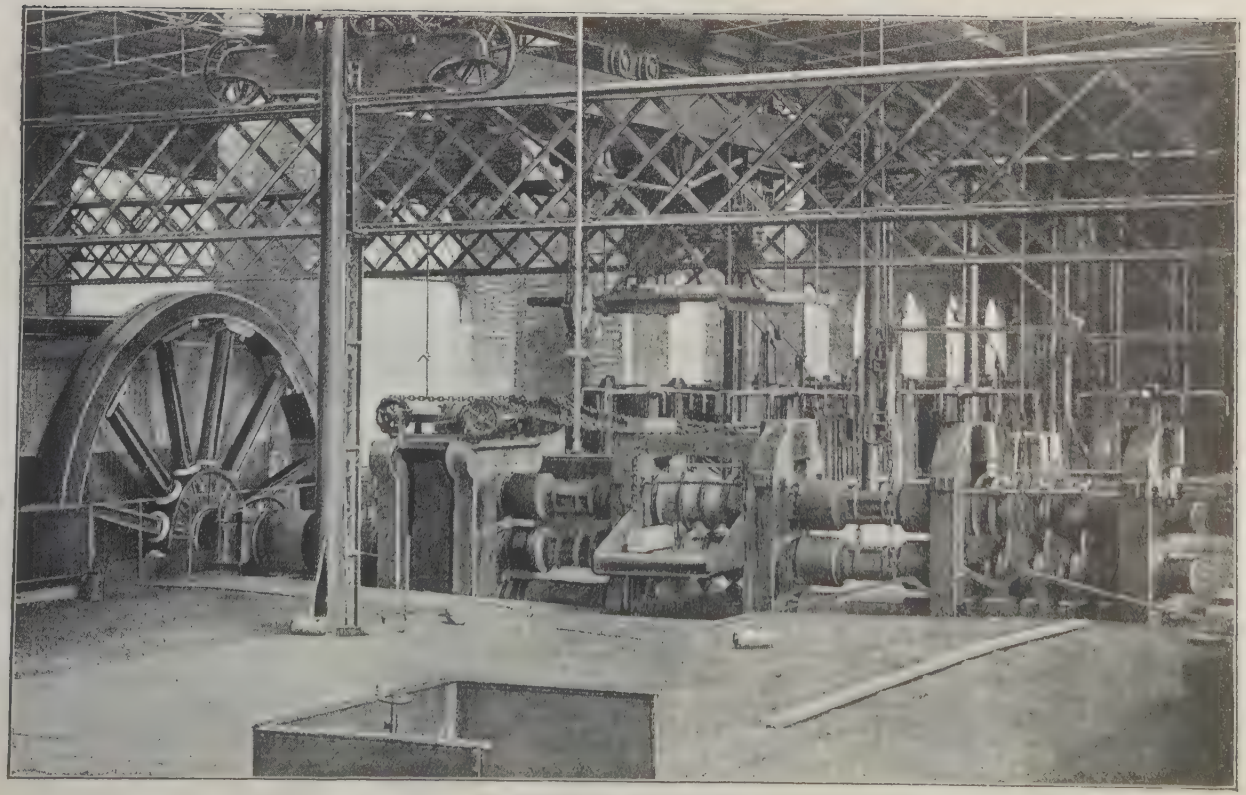
made. At Wolverton, for instance, one day I came upon a man engaged in etching designs upon the plates of ground glass that were to form the windows of the lavatory compartments, and was told that the Company had recently found that it could do this work for itself at half the price it had formerly paid.

Of course, on the general question there are strong arguments on both sides. On the one hand, it is said that neither the directors nor their loco. superintendent have the time and experience necessary to manage half-a-dozen different manufacturing businesses simultaneously, nor have they the stimulus to economy that is applied to other manufacturers by the necessity of making both ends meet; they have the bottomless purse of a great company to draw upon, and their losses as manufacturers are buried in the centre of a pile of accounts and balance-sheets, showing their profits as carriers. On the other hand, it is easy to reply that manufacturers do not work for nothing, and that their profit at least is saved; further, that a manufacturer, whether a private person or a company, has to pay a far higher rate for money borrowed, and expects far higher interest for his own capital, than that with which a railway shareholder is content; and that the advantage of getting supplies as and when required, instead of having to wait the convenience of an independent manufacturer, is also worth something, though it may be difficult to appraise that worth in money. After all, however, the practical experience of a great company such as the North Western, which no one has yet been found to call an ill-managed or extravagant line, is of more value than many pages of abstract theory.

Indeed, the popular opinion of this line, which would represent it as being among railways much what a Bond Street shopkeeper is in comparison with his fellow tradesmen, with a large-minded indifference to what Mr. Besant calls "the law of elevenpence-halfpenny," is strangely at variance with the professional estimate. Everybody knows that North Western engines are painted black, but every-

body does not know that this is because black is the cheapest colour that there is. Nor does everyone know that Crewe engines have many parts made of cast iron and covered with paint that other companies produce in wrought iron, with polished surfaces. Never shall I forget the tone of immeasurable scorn with which one of the *employés* in the locomotive department of another great company remarked, "We say here that the Crewe engines are made up of the best cast iron and the best lamp-black." Not long since, at the Institute of Civil Engineers, Mr. Webb was reproached by a brother engineer for his parsimony in this very matter of paint; to which he promptly replied that, as soon as his shareholders had got 10 per cent. for their money, he should be quite ready to cover his engines with gold leaf. Here is another instance of the same spirit. The Company's notice boards all over the line and on the hoardings of every large town in the country have at the head of them the legend "London and North Western Railway Company," or what not, always conspicuous in raised letters. For my own part, I used to look upon the practice as convenient for the public, but extravagant. At Crewe I learnt that what I had fancied an extravagance was in fact an economy. The letters are simply cast iron, produced at an almost nominal cost, and screwed on to the board. When they become dirty any common labourer with a brush full of white paint can make them legible again; to retouch letters shaded in the ordinary fashion on a flat ground requires the employment of a skilled workman. But it is high time that we got back into the rail mill.

As we enter, the Bessemer converter has just been charged, and we can watch how, in the fierce blast, the iron is turned to steel, with a storm of sound and a splendour of flame that must surely have suggested to Mr. Rider Haggard the weird transformation scene of "She." How long Ayesha spent in the midst of the Fire of Life we are not told, but it takes about twenty minutes

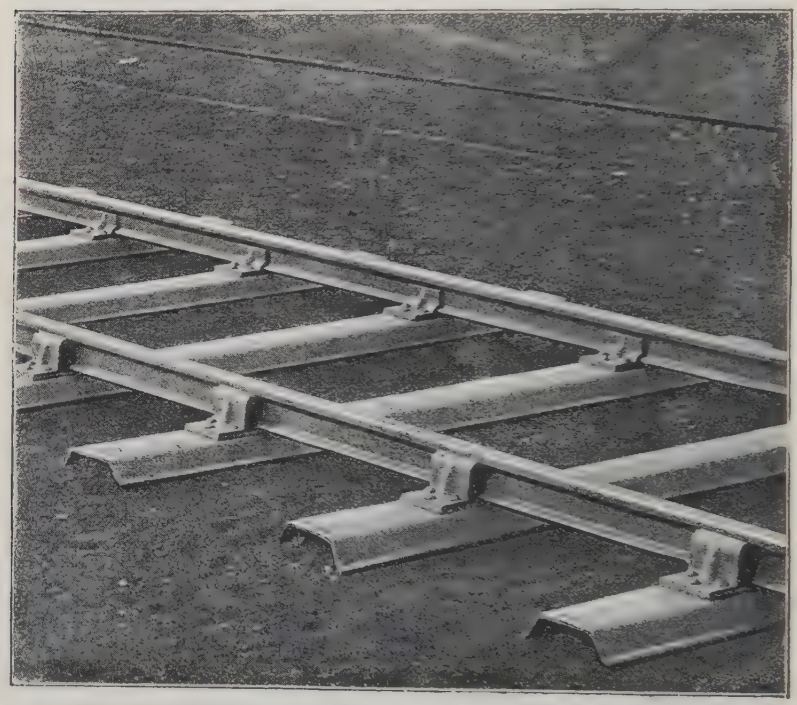


to burn the impurities out of a charge of molten iron. By the end of this time the flame has changed from orange to a blue white, the sparks have almost ceased to fly, and it only remains to pour in the "dose" of *spiegeleisen* and empty the converter into the "ladles"—a mere spoonful of some seven tons. The ladle moves round and round, and up and down, on a platform that is worked by hydraulic power, and in its turn empties the steel into the ten or a dozen moulds that stand round in a ring. Each mould contains an ingot, or "bloom," as it is called, some 3 feet long and 10 inches square.

As soon as the ingot has cooled sufficiently to leave the mould, it is taken to a furnace and re-heated. It is then passed rapidly backwards and forwards through a series of swiftly-revolving rollers, each successive pair of rollers being closer together than the preceding pair. After two or three passages in each direction the ingot has become a bar. The process continues, the bar becomes longer and thinner; the rollers are now no longer plain but grooved; the top and bottom of the bar flatten out, the sides simultaneously belly in, and in forty seconds, during which the blinding white of the metal has faded to a dull red, the rolling is complete and the rail finished. Before, however, it is finally laid aside to cool, it is dragged to a saw which cuts it off to the standard length of 30 feet, next to a plane which trims up and squares the ends, and lastly to a third machine which, with a nudge here and a push there, straightens out even the most imperceptible bend.

The "crop-ends" of the rails go back once more to the furnace and are heated afresh; then a smaller series of rollers flattens them out into bars some 5 inches in width and half an inch in thickness, and 5 or 6 feet long, according to the amount of material available. A second machine cuts the bars into lengths of 18 inches to form the "fish plates" that are used to fasten the individual rails together so as to make a continuous road, then shapes each plate so that it may fit exactly the sides and bottom of the rail; a

third stamps upon it with a Nasmyth's hammer to knock off the scale; a fourth punches four bolt holes through it: and then with just one more squeeze, lest the plate should have got a twist or a bend anywhere, the process is completed. Hard by stands a machine which breaks up old rails, to feed



STEEL PERMANENT WAY.

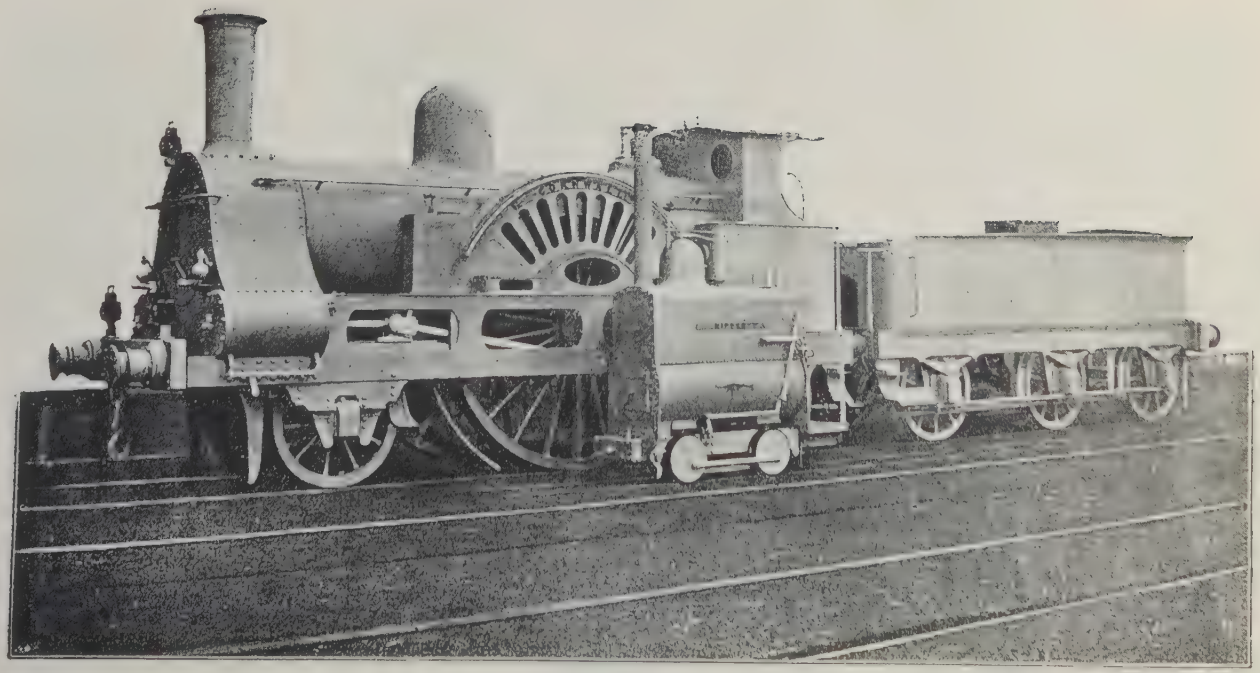
the Bessemer converter, in the same manner and with as little apparent effort as a man snaps a stick across his knee.

Alongside, too, steel sleepers, one of the latest and not the least ingenious of Mr. Webb's numerous patents, are being rolled out by somewhat similar machinery, and steel chairs are being stamped out of a fresh stock of "crop-ends," under the blows of a Nasmyth's hammer. The chairs are formed of three pieces, riveted to one another and to the sleeper,

from which, in order to exclude moisture, they are separated by a layer of tarred paper, with six rivets apiece. The rivets are forced through the holes and pressed out into heads by hydraulic power as easily and quickly as a dairy-maid presses out pats of butter. The system is completed by steel springs, which take the place of the ordinary oak wedge or "key" that fixes the rail tight into the chair. About 60,000 of these sleepers have up to the present been made, and about thirty miles of the North Western line are laid with them. It is too soon yet to speak of results, but so far at least they seem to be successful. It is commonly supposed that steel sleepers would make the road less elastic and the vibration and jar of the carriages more perceptible, but the present writer can say, from personal experience, that neither in the carriage nor indeed on the engine of an express train could he perceive any difference, even though he knew he was passing over them. Experienced officials, however, say that they believe they can detect it when their attention is specially directed to the matter. We shall have occasion shortly to notice the marvellous capacity of trained railway men to feel their way along the road, so to speak, by sound. The question involved in the conflict between steel and wooden sleepers is literally one of gigantic magnitude. A rough calculation shows that to replace the wooden sleepers on existing lines in Great Britain would require about 4,000,000 tons of steel, without reckoning the weight of the chairs and keys. And Great Britain has only one-sixteenth of the railway mileage of the world. The adoption of steel sleepers might well postpone the destruction of the American forests for another generation.*

The Crewe locomotive shops have to build and keep in

* Many other companies are experimenting, or have experimented, with other patterns of steel or iron sleepers. The new extension of the Metropolitan to Rickmansworth, for instance, is laid with them. [North Western and Metropolitan have both abandoned steel and reverted to wood, and so far as England is concerned the question is at rest for the present. 1899.]



'DIGNITY AND IMPUDENCE,' THE 'CORNWALL' AND THE 'NIPPER.

repair a stock of engines that is worth £5,000,000 sterling, and that, while it does not indeed put a girdle round the earth every forty minutes, literally does so every four hours. And, according to Mr. Webb, it is only once in every alternate journey round the world that any mishap occurs as serious as even the heating of an axle or the loss of a split-pin or cotter. Crewe has not often turned out an engine more interesting than the old 'Cornwall,' which on the opposite page plays 'Dignity' to the 'Nipper's' 'Impudence,' and is, one may safely say, the only engine running 50-miles-an-hour expresses to-day that was built fifty years ago and exhibited in the Great Exhibition of 1851. And, now that the Bristol and Exeter tank engines with 9 feet wheels are dead, the 'Cornwall' can unquestionably claim that her 8 ft. 6 driving wheel is the largest in the world. But, as she runs now between Liverpool and Manchester, she must look very different from what she did when she was first turned out by Mr. Trevithick, for in those days her boiler was below the driving axle. Since Charles II. puzzled the Royal Society with his famous question why a live fish displaced more water than a dead one, there have not been many instances in which the philosophers have more complacently and unanimously assumed their premises, than in the universally accepted doctrine of the engineers of the last generation that a low centre of gravity was imperatively necessary for the safety of a fast-running locomotive.

One other Crewe-built engine deserves a word of notice—the 'Charles Dickens,' which may claim to have gone nearer than any other machine yet constructed to solving the problem of perpetual motion. Four hundred miles is a very good average week's work for an ordinary engine. The 'Charles Dickens' has been covering, if not 400, at least 367 miles six days a week, for nearly two years past. Starting from Manchester at 8.15 A.M., she—fancy 'Charles Dickens' a "she"—is in London at 12.40, rests till 4, and is back in Manchester at 8.15 P.M., exactly 12 hours out and

home. But 150 miles is a day's work for North Western drivers, so the engine has two sets of men, the one of whom drive her on Mondays, Wednesdays, and Fridays, and then take a holiday while the other gang are in charge, on Tuesdays, Thursdays, and Saturdays.*

In maintaining its stock of locomotives, Crewe every five days withdraws a worn-out engine and replaces it by a new one. But the locomotive shops have been described often enough. Of the boiler-shop, where he noticed one man at work riveting inside a fire-box, while two lusty mates hammered outside, Sir Francis Head in 1849 wrote as follows: "We could not help thinking that if there should happen to exist on earth any man ungallant enough to complain of the occasional admonition of a female tongue, if he will only go by rail to Crewe and sit in that boiler-shop for half an hour, he will most surely never again complain of the chirping of that 'cricket on the hearth,' the whispering curtain lectures of his *dulce domum*." I saw (and heard) no reason to suppose that the boiler-shop had become more silent since the date of Sir Francis Head's visit.

But Sir Francis saw nothing of what is nowadays perhaps the most interesting thing at Crewe, the compound locomotive. Still, it was only the year after his visit, long before the compound marine engine had ever been dreamed of, that an engine-driver on the Great Eastern (then the Eastern Counties) Railway, Mr. John Nicholson by name, suggested a form of compound locomotive. Two engines were built on his design, and according to two papers read by Mr. Samuels, the loco. superintendent of the Eastern Counties, before the Institute of Mechanical Engineers in January and April, 1852, they yielded highly satisfactory results. Strange to say, no record seems to survive, either at Stratford or elsewhere, to show what was the subsequent fate of these old compounds, how long they ran, or why they were finally discarded. But, as far at least as England is

* [The 'Charles Dickens' is still running the same trains, and on the 31st of May its record was 1,748,239 miles. 1899.]

concerned, the question appears to have slept from 1852 for a quarter of a century, though M. Mallet in France, and Herr von Borries (the co-patentee with Mr. Worsdell of the system now in use on the North Eastern) in Germany, had two-cylinder compounds at work as early as 1876 and 1879 respectively. It was in consequence of a series of experiments, carried on for several years with an engine of the Mallet type, that Mr. Webb in 1881 struck out a new line of his own. In this latter year he patented a form of engine with two small high-pressure cylinders and a third low-pressure one, 26 inches in diameter, placed between the front wheels. The engine was appropriately named the 'Experiment.'

The result Mr. Webb must tell in his own words: "Before it was painted he hooked it on [at Crewe] to assist a heavy express from Liverpool with nineteen coaches. He tried it with steam shut off from the other engine for some distance along the Trent Valley. They ran without trouble from Crewe to London. When the engine arrived in London it was all right, and he had it turned round and hooked it to the morning mail, which it took to Holyhead. When the engine arrived at Holyhead it was still all right, and he then gave the men something to eat, turned the engine round, and hooked it to the boat express, which it took to Crewe. The engine thus did 528 miles as a christening trip." The 'Experiment' was so successful that it was followed by the 'Economist' and numerous others. The 'Compound,' a more powerful engine with larger cylinders and slightly smaller wheels, began its career by drawing the 10 o'clock Scotch express, with a load of thirteen coaches weighing upwards of 160 tons, straight away from London to Carlisle. At the foot of Shap Fell, with its gradient of 1 in 75 for five miles, it paused for one moment disdainfully to refuse the assistance of the "bank" engine, that was in waiting according to custom to help the train up the incline, and then pursued unaided its victorious career.

Since that time the Crewe shops have turned out upwards

of seventy compounds. One of the latest and largest, belonging to what is known to the officials as the 'Dreadnought' class and to drivers as 'Jumbos,' took Her Majesty to Scotland some time back, and drew the fifteen saloons of the royal train up Shap without assistance. Another, the 'Marchioness of Stafford,' which was exhibited in a conspicuous position in the "Inventories" in 1885, and gained for its inventor a gold medal, ran through to Carlisle one night in July with no less than "twenty-one coaches on the Limited Mail," and even with this load was going fifteen miles an hour when "she" reached Shap Summit. A 'Jubilee' engine, 'No. 3000,' which in size and power eclipses even the 'Jumbos,' which, moreover, is to work with steam at a pressure of 180 lbs., was, as we have already mentioned, built in 1887. But the type may now be taken as settled. It has lately been adopted also for goods engines, and a specimen of this latter kind was on view in the recent Manchester Exhibition. Engines constructed on the Webb principle are already working on numerous foreign and Colonial lines, and one is now ordered for the United States, to undergo a series of trials on the Pennsylvania Railroad.

The advantages claimed for the invention—and rightly claimed, to judge by the experience of some seven or eight million miles running on the North Western—are twofold. On the one hand, the compound engine is considerably more powerful than the ordinary engine of the same weight. As we have seen, it can take up steep inclines loads that had never hitherto been attempted without a second or "pilot" engine. Secondly, there is a marked economy of fuel, amounting to about 6 lbs. per mile. This to lay ears may sound a trifle, but when we learn that the North Western Railway runs 40,000,000 miles per annum and pays a yearly coal bill of not far short of £300,000, we may perceive that a reduction of the consumption of coal from 36 to 30 lbs. per mile would be to the shareholders by no means a trifle.

It ought to be mentioned that compound engines are not

without their detractors, who number amongst them some of the foremost engineers in the country. The opposition argument takes two forms. There is a theoretic objection which says that a locomotive has no time to use its steam expansively (or at least to expand it more than is always done by the driver of an express engine who "cuts off" almost at the beginning of the stroke) in the quarter of a second which elapses between one stroke of the piston and the next. The practical objection says, the compound engine, with its three cylinders, has more parts and is more complicated. It is, therefore, more costly to build and to keep in repair, more liable to get out of order, and in any case more extravagant in the consumption of oil and tallow. Further, the heavier pressure of steam that the compound system implies means greater wear and tear of boilers, and more rapid destruction of the fire-box and the boiler tubes. All these extra expenses more than overbalance the value of the alleged saving in coal. In such a contest it would obviously be absurd for outsiders to intervene. Mr. Webb would, no doubt, answer, "*solvitur ambulando*," or rather "*currendo*."*

There are three methods of getting to Crewe, all of them more interesting than the usual method of travelling in an ordinary compartment. These are, to ride on the engine, in the sorting vans of the newspaper train, or in the Post Office vans of the special mail that leaves Euston every night at 8.30 P.M. At the same time it must be confessed that even the unfailing courtesy of the North Western officials would not enable them to place any one of these three modes of travelling at the disposal of any considerable section of the public at large, so perhaps it may be worth while to describe them in somewhat more detail.

Fifty years ago a place on the foot-plate of an engine was looked upon much like the box seat of a stage coach. A

* [Brief notice of the recent history of compounds in this country will be found in the Supplementary Chapter. 1899.]

well-known passenger could have it for the asking, and half-a-crown would probably secure it for a stranger at any time. A veteran driver, familiarly known as "Billy" Smith, who from 1836 till April, 1887, drove an engine in the service of what is now the North Eastern Company, recorded last year in the columns of a railway newspaper that "when he first got married it was no unusual thing for his wife to go with him on the engine to Shields for marketing purposes." At an even earlier period, a lady more famous than Mrs. Smith with her market basket took a journey on an engine from Liverpool, along the as yet unopened Liverpool and Manchester line. Her companion was George Stephenson himself. But Fanny Kemble must tell her tale in her own words:—

LIVERPOOL, *August 26th* [1830].

"MY DEAR H.,

"A common sheet of paper is enough for love, but a foolscap extra can alone contain a railroad and my ecstasies. . . . We were introduced to the little engine which was to drag us along the rails. She (for they make these curious little fire-horses all mares) consisted of a boiler, a stove, a small platform,—a bench, and behind the bench a barrel, containing enough water to prevent her being thirsty for fifteen miles—the whole not bigger than a common fire-engine. She goes upon ten wheels, which are her feet, and are moved by bright steel legs called pistons*: these are propelled by steam, and in proportion as more steam is applied to the upper extremities (the hip-joints, I suppose) of these pistons, the faster they move the wheels; and when it is desirable to diminish the speed, the steam, which unless suffered to escape would burst the boiler, evaporates through a safety-valve into the air. The reins, bit, and bridle of this wonderful beast is a small steel handle, which applies or withdraws the steam from the legs or pistons, so that a child

* It should be remembered that the 'Rocket' (if this was the 'Rocket'), as originally built, had, like most of the old engines, her pistons working almost vertically downwards from the cylinders.

might manage it. The coals, which are its oats, were under the bench, and there was a small glass tube affixed to the boiler, with water in it, which indicates by its fulness or emptiness when the creature wants water, which is immediately conveyed to it from its reservoirs. There is a chimney to the stove; but, as they burn coke, there is none of the dreadful black smoke which accompanies the progress of a steam-vessel. This snorting little animal, which I felt rather inclined to pat, was then harnessed to our carriage, and, Mr. Stephenson having taken me on the bench of the engine with him, we started at about ten miles an hour. . . .

"You can't imagine how strange it seemed to be journeying on thus, without any visible cause of progress other than the magical machine, with the flying white breath and rhythmical unvarying pace, between these rocky walls, which are already clothed with moss, and ferns, and grasses; and, when I reflected that these great masses of stone had been cut asunder to allow our passage thus far below the surface of the earth, I felt as if no fairy tale was ever half so wonderful as what I saw. Bridges were thrown from side to side across the top of these cliffs, and the people looking down upon us from them seemed like pigmies standing in the sky. I must be more concise, though, or I shall want room. . . . We had now come fifteen miles, and stopped where the road traversed a wide and deep valley. Stephenson made me alight, and led me down to the bottom of this ravine, over which, in order to keep his road level, he has thrown a magnificent viaduct of nine arches, one of which is 70 feet high, through which we saw the whole of this beautiful little valley. It was lovely and wonderful beyond all words. . . . He explained to me the whole construction of the steam-engine, and said he could soon make a famous engineer of me, which, considering the wonderful things he *has* achieved, I dare not say is impossible. His way of explaining himself is peculiar, but very striking, and I understood without difficulty all that he said to me.

"We then rejoined the rest of the party, and the engine having received its supply of water, the carriage was placed

behind it, for it cannot turn, and was set off at its utmost speed, thirty-five miles an hour; swifter than a bird flies (for they tried the experiment with a snipe). You cannot conceive what that sensation of cutting the air was; the motion is as smooth as possible too. I could either have read or written; and, as it was, I stood up and with my bonnet off 'drank the air before me.' . . . When I closed my eyes this sensation of flying was quite delightful, and strange beyond description; yet, strange as it was, I had a perfect sense of security and not the slightest fear. At one time, to exhibit the power of the engine, having met another steam carriage, which was unsupplied with water, Mr. Stephenson caused it to be fastened in front of ours; moreover a wagon laden with timber was also chained to us, and thus propelling the idle steam-engine, and dragging the loaded wagon which was beside it, and our own carriage full of people behind, this brave little she-dragon of ours flew on. Further on she met three carts, which being fastened in front of her, she pushed on before her without the slightest delay or difficulty. When I add that this pretty little creature can run with equal facility either backwards or forwards, I believe I have given you an account of all her capacities.

"Now for a word or two about the master of these marvels, with whom I am horribly in love. He is a man of from fifty to fifty-five years of age: his face is fine though careworn, and bears an expression of deep thoughtfulness: his mode of explaining his ideas is peculiar and very original, striking, and forcible; and although his accent indicates strongly his north-country birth, his language has not the slightest touch of vulgarity or coarseness. He has certainly turned my head"

It might not perhaps be easy, however, to find a third instance of a woman who has travelled on an engine. Here at least is what Sir Cusack Roney, himself a railway official, writes in his *Rambles on Railways*, which was published in 1868: "Reader! have you ever travelled on a locomotive?

We believe not; at least there have been very few of you of the male sex, none of you of the gentler, for there is a law on railways like that of masonry—railway engines are 'tiled' against crinoline." Certainly, nowadays, the driver who admitted any person even of the male, to say nothing of the gentler sex on to his engine, without the written authority of the locomotive superintendent, would think himself very lucky, and would need to have a very irreproachable character, to escape with nothing worse than a fine of a sovereign. Nor can it be denied that the rule is rightly made stringent. Whatever may be the case elsewhere, on the foot-plate at least three is an awkward number. But this is by no means the only objection. An accident is at any moment within the bounds of possibility, and the engine-driver who, if he was in fault, refrained from asserting that the most innocent of passengers had distracted his attention, would be more than human. Nor could his statement be disproved. "Ask me anything but that," has been the answer of more than one General Manager to my request to be allowed to travel on the engine of some famous express. "We don't like to be told by the papers," added one of these gentlemen, "that we are coolly indifferent to human life."

This charge indeed, though often made, is not more cruelly unjust than it is foolish. There is no need to see the shudder with which an undemonstrative, hard-headed railway official will speak of some accident that happened years ago perhaps in order to realise that the man who has actually seen the mangled bodies of the dead and heard the groans of the dying is likely to be at least as much affected as the gentleman who, sitting at home at ease, reads the account in his morning's *Times*. Granted, however, that the railway profession were (as Macaulay describes Charles's Court) a "paradise of cold hearts," it can hardly be said also to be one of "narrow minds." And the manager who does not know that an accident is enormously costly, not only in the damage it causes and the compensation it implies (the

Hexthorpe collision is said to have cost the Sheffield Company well over £50,000), but still more in the loss of the traffic which it frightens away—that manager must undeniably know less of his own business than the meanest porter's boy. But we have waited an unconscionable time to join the engine for which we have been fortunate enough to secure a pass.

Even the quick fancy of Fanny Kemble would probably not see much to marvel at on the "bench" of an engine nowadays. The snorting she-dragons have grown as familiar and commonplace as the viaducts and cuttings along which they pass. But there was one thing that struck me forcibly on this, my first journey on an engine, after having got over the sensation of being as much too hot on the one side as too cold on the other, and having ceased to notice the hardness, and still more the greasiness, of the seat, and that was that the North Western Railway runs across a desert. Sitting in a carriage and looking out of the window on either side, one seems to be travelling through green fields and pleasant parks and pastures. But, rushing through the air fifty miles an hour on the engine, one is forced by an irresistible fascination to strain one's eyes gazing forward through the windows of the "cab"; and through them nothing is visible but the great broad gravel highway, with its eight gleaming lines of polished steel stretching onward and ever onward before us. It is true that here we overtake a caravan toiling northwards on the "slow" line, there we meet a second wending its way south, but they are only seen one moment to be lost sight of the next. Anon we dash with a roar and a rattle through a station, or scatter before our rush a group of platelayers; but these points are only rare oases along our track.

An hour after leaving Willesden we speed through Wolverton, a station that has fallen from its high estate of forty years ago, when every train, from the up mail at 4 A.M. to the down York mail at 11 P.M., stopped for ten minutes at the famous refreshment-rooms. Gone are the "seven very

young ladies to wait upon the passengers" in whose praise Sir Francis Head waxed so eloquent; gone the "eighty-five pigs and piglings, impartially promoted one after another by seniority into an infinite number of pork pies"; eaten the last of the 182,500 Banbury cakes, the 56,940 Queen's cakes, the 29,200 pâtés—though on this latter point I am not quite so sure, as I saw what may have been a survival of the eocene epoch of railway travel on a station buffet not long since.*

But it matters little to us at this present moment; a touch of the driver's whistle, and the station disappears in the distance before we have had time to do more than catch a glimpse of the great carriage works. A minute or so later the driver makes signs to his passenger—the noise of the train and the fury of the wind as we hurry through the air at the rate of 50 miles an hour render speech difficult, if not impossible—to move from the right-hand side, where he has hitherto been standing out of the way of the fireman's busily-plied shovel, to the left. The engine is about to take in water. The driver lowers the scoop down from the tender into the trough between the rails, the fireman stands ready to watch the rise of the water in the tank, we hear a hollow sound as the iron of the trough rings beneath our feet, then a rush of water, ten seconds more the water is splashing up against the top of the tank; by the united strength of driver and fireman the scoop is hastily drawn up, and we are speeding on our way with the water-troughs lying far behind us. The men do well to be prompt; cases have been known

* It is worth mention, as a proof of the change of social habits, that Sir Francis gives a table of the consumption of seven different kinds of alcoholic drink, ranging in quantity from 45,000 bottles of stout to 464 bottles of rum. Whiskey is not so much as mentioned. It was, I believe, almost unknown in England, while even in Scotland, at least in the Lowlands, its use was practically confined to the lower orders. Worth mention too, as a specimen of the stern, almost Continental, discipline that was exercised by the Companies over their passengers in days when competition as yet was not, is the regulation that ordained that only bottled beer should be drunk, and that "draught bitter" should not be allowed on the premises.

WATER TROUGHS

where they have neglected or failed to lift up the scoop in time, and the water has overflowed the tank, flooded the tender, set pick and shovel and coals all afloat, and surging up against the fire-box door, gone near to putting the fire out altogether. At the points where the troughs begin and terminate the line rises slightly. By this means both the water is prevented from running out of the troughs, which cannot have ordinary ends lest a scoop should strike against them, and also the scoop is automatically pushed up and the pipe closed, if the driver fails to lift it before the engine reaches the end of the trough.

The run of the 'West Coast Flyer,' as the enthusiastic correspondent of the *New York Times* christened the Edinburgh express last August, from London to Crewe without a stop, has lately called special attention to this system of picking up water *en route*, so it may be as well to say a word or two more on the subject.

The credit of the introduction of the idea in England belongs to Mr. Ramsbottom, who took out a patent for it in the year 1860, at the time when he was locomotive superintendent of the North Western. Troughs are now laid down at five different places on the North Western main line, near Watford, Roade, Tamworth, Warrington, and Tebay respectively; at two points between Chester and Holyhead, and at one point on the 30 miles' run between Liverpool and Manchester. Though the system has long been in common use in America, where it was first proposed as far back as 1854, it had not till quite lately been adopted on any other English line, and we shall hardly be far wrong in assuming that the recent adoption of the system by that marvellously rejuvenescent company, the Lancashire and Yorkshire, is not unconnected with the fact that the directors have been fortunate enough to secure Mr. Ramsbottom as their colleague. Why the other companies have hesitated so long to accept the innovation it is difficult to say.* I

* [See Supplementary Chapter for the names of other companies which have recently followed suit. 1899.]

have been assured by one locomotive superintendent that the North Western, to whom the patent rights belonged—they have now expired—demanded a prohibitive royalty; on the other hand, I have been told by a North Western official, who should be able to speak with authority, that no serious application for a licence has ever been made. The advantages of the system seem almost self-evident.

It would be a mistake to think that troughs are laid down merely to enable express trains to run great distances without stopping. That is, of course, one gain, as was shown last summer, when the 'Marmion' and the 'Waverley,' with a tender capacity of some 1800 gallons of water, ran 158 miles to Crewe without a halt, while the huge Great Northern engines, which start with well over 3000 gallons on board, had to stop at Grantham after only covering two-thirds of the distance. Distinguished engineers, however, are found to assert that the gain here is purely imaginary, as a fresh engine, with a clean fire, will more than economise the five minutes required for a stop, as compared with another whose fire bars are choked with dross and clinkers that have formed in the course of two hours' run. But the invaluable rhyme, which teaches us that

> "A pint of water
> Weighs a pound and a quarter,"

will show that the difference between 1800 and 3300 gallons means that the Great Northern engine was carrying about with it some seven tons of superfluous load. Nor is this all; at King's Cross the tender weighed say 35 tons, and when the train got to Grantham it weighed only about 20, and the springs that are strong enough to carry the larger weight must surely be too stiff to ride easily with the smaller. And, if the tender takes to bumping and jumping, it must set up oscillation throughout the train, to the injury of the permanent way and the discomfort of the passengers. But the gain to goods engines and the engines of stopping passenger trains, which do not need to block the platforms

of crowded passenger stations, or the roads through crowded goods yards, while they are taking in water, and which are ready for shunting work as soon as ever they arrive at the station, must be at least equally great, or the North Western would never have laid down troughs for the use of the local traffic between Liverpool and Manchester.

Nor does this exhaust the advantages of the system. Engines, like human beings, are apt to run up long doctor's bills, if the water that they drink disagrees with their constitution. Said a locomotive foreman to the writer some time back: "I have two running-sheds under my charge: in the one there are forty engines, in the other there are fifteen; and, owing to the hardness of the water, the fifteen cost three times as much for boiler repairs as the forty." Indeed, in not a few large loco. sheds it is found economical to establish a special water-softening apparatus. The North Western locomotives evaporate into steam about 4,500,000 gallons of water *per diem*. A rough calculation shows that, if all the water they used was as hard as that supplied to Londoners by the Kent Waterworks (30 parts of carbonate of lime in 100,000 parts of water), there would be about 6 tons of scale left behind every day to injure the boilers and clog the tubes. If it was all as soft as that supplied by the Colne Valley Company (4·5 parts per 100,000), the amount of scale would be less than one ton. Now, with the Rams-bottom troughs, the engine goes to fetch its own water, and there must usually be some point on the line where the water is good; if the engine is to be supplied in the ordinary way, it must put up with the water, good, bad, or indifferent, that it can get at the stations at which the exigencies of the traffic require it to stop. All that is needed for the troughs is a stretch of level line, not more than half a mile in length, somewhere in the neighbourhood of a spring of good soft water, and one would think that this might be found, even on the Settle and Carlisle or the South Devon.

At Roade we part company with the "slow" lines, which turn off to the right, round through Northampton and

skirting Althorp Park. A few minutes later we are in the famous Kilsby tunnel, and hurrying onward through the deafening roar and the gloom, weirdly illuminated with spasmodic gleams from our engine chimney. Before us—miles away it looks—lies a spot of blinding light, but when we reach it it is nothing but the bottom of a ventilating shaft that opens right up to the sky above. A minute or two more, and passing under the down "slow" line that, regardless of cost, has been carried over our heads to avoid any risk of collision at the junction, passing too a signal-box, almost the largest in the world, 100 feet in length and containing nearly 200 levers, we slacken speed through the maze of signals into Rugby Station, and draw up at the platform, 89 minutes after leaving Willesden, 77¼ miles distant.

Perhaps to a stranger on an engine nothing is so remarkable as the signalling and the organisation of the trains. A moment ago, that signal before us was, we know, at danger; a moment hence it will be at danger again; but at the present instant it gives "line clear," and through we dash unchecked; and so it will be mile after mile and hour after hour. Not long since the present writer came up from Manchester to London on the eve of a Bank Holiday. There were a hundred and fifty-nine separate block sections to be crossed, each with its distant and its home signal. But, of the whole three hundred and eighteen signals, only one was at danger, and that but for an instant. There has perhaps never been such a triumph of the *vox populi* over the opinions of the experts as is to be found in the adoption of the block system. "We shall never be able to work our traffic with it," said great authorities like Sir John Hawkshaw, little more than a dozen years back. "We never could work the traffic without it," would be the equally unhesitating answer of the manager to-day. "It is astonishing," writes the American engineer, Mr. Dorsey, in 'English and American Railroads Compared,' "to see the blind faith the English engine-driver places in his block signals. In dense fogs, where he cannot see a hundred feet ahead, or dark nights,

when his vision is also very limited, for his head light is only an ordinary lantern, useless for illuminating the track and only used as a signal, the same as the tail light, or frequently where he has both the dark night and the dense fog to run through, yet he runs at full speed, and generally on schedule time, feeling sure that he is perfectly safe, because his block signals have told him so, and they cannot make a mistake or lie."

And now let us make an abrupt transition from the Saturday afternoon before a Bank Holiday to the half-awakened solitude of Euston at 5 A.M. Not that the silence and solitude last long, for the newspaper train starts at 5.15. A rumbling of heavy wheels driven at speed is heard, and big spring vans dash up, piled with papers still damp from the press. Bundle after bundle is tossed into the foremost of the sorting vans, of which there are three joined together with gangways opening between. Of passenger carriages on the train there are two, but the passengers might be counted on one's fingers. The clock points to twelve minutes past the hour, the papers are all in the train, but the chief sorting clerk looks anxiously at the clock, and then out into the station yard. The *Times*, it appears, does not come with the other papers from the office in the Strand, but is sent direct from Printing House Square, and it has not yet arrived. The minute hand reaches the quarter; time waits for no man, not even for the Editor of the *Times;* the guard blows his whistle, we step in, and the train moves off. At the same moment is heard a "rushing of horse hoofs from the east"; the train is stopped before it has gone twenty yards, the van gallops into the yard, and every official in the place, from the inspector and the sorting clerks to the lamp man, precipitates himself upon it, before there has been time to pull the horses on to their haunches. In less time than it takes to describe, the bundles of papers are transferred, and by 5.17 we are again under weigh, having seen a sight that, so at least the officials declared, had never before been seen by mortal eyes.

No sooner are we started than folding counters are fixed up along the sides of the vans and the sorting begins. In the front van the bundles are reduced to manageable size, the reams of the *Standards* or *Telegraphs* split up into quires or dozens. In the second van the parcels are made up for each place, so many *Times*, *News*, or *Post*, so many odds and ends, weeklies, evening papers of the night before, and so on till the whole of the requisitions of each list are complied with. Then the finished parcel is handed on into the third van, where are two servants of the Company who receive it, weigh it, enter it in a way-bill, and debit the cost of carriage to Messrs. W. H. Smith's account.

We took down with us in the sorting vans in all between thirty and forty thousand copies of the morning papers, and as our journey was on a Tuesday morning we took little else. The work gets heavier as the week gets older. Monday, when no weeklies are published, is the lightest day of all. Tuesday the society papers begin with the *World*. On Wednesday come *Punch* and *Truth*, and the rest of the comic journals, till finally, on Saturday, the multitude is almost overwhelming. The sorting vans went, at the time of my visit, no further north than Stafford, and long before this point was reached huge bundles had been turned out at Northampton and at Rugby for Leamington, Coventry, Birmingham, and its neighbourhood. If at Stafford the work was still unfinished, the Shrewsbury train used to have to wait till the sorting of the newspapers for the Welsh lines had been completed in a siding. But on this particular morning the work was accomplished well within the time, and we were able to study the political leanings of the different towns at our leisure.

Tuesday, however, as already mentioned, is a light morning, and later on in the week it sometimes happened that not only the papers for the Welsh lines, but also those for the north, were not finished by the time the train reached Stafford. This meant that the main line train (which has connections from everywhere to everywhere as far north as

Aberdeen) had to wait, and of this naturally enough the North Western authorities complained. So it was arranged a year ago that the sorting vans should run on as far as Crewe, an arrangement that since then has worked perfectly. Last summer, however, the stop at Stafford was taken off, and the "outs at Stafford," the papers, that is, for Shrewsbury and Wales on the one hand, and for Stoke and the Potteries on the other, have had to be got ready in time to be handed over at Rugeley to a slow train that follows immediately after the express has passed. For the North Western absolutely prohibits the simple but risky plan that is sometimes adopted of throwing out bundles from a train passing through a station at speed.

The newspaper train has another, though somewhat esoteric, title to fame. It reaches Wigan at 10.10 A.M., bringing with it carriages for Carlisle, for Glasgow, and also two to be detached at Wigan. At this latter place it is joined by the 9.55 from Manchester, with through carriages for Edinburgh as well as Glasgow, also by the 9.35 from Liverpool, with carriages not only for Edinburgh and Glasgow, but for Blackburn and Perth in addition Here is a piece of marshalling that for complexity is probably unequalled in the world. The train is timed to leave for the north after an interval of twenty minutes, and in the meanwhile a good deal of shunting has got to be done before it can start at 10.30 in the following order:—

Marshalling of the 10.30 A.M. *ex Wigan.*

3	carriages	from	Crewe for Carlisle.
2	,,	,,	Liverpool for Edinburgh.
1	,,	,,	Manchester for Edinburgh.
2	,,	,,	Manchester for Glasgow.
2	,,	,,	Liverpool for Glasgow.
1	,,	,,	London for Glasgow.
3	,,	,,	Liverpool for Perth.

It is commonly said that every North Western official has been down to Wigan to see who can find the best solution of

the puzzle. It is also whispered that no one is quite satisfied with any solution that has hitherto been offered.

When, thirty-eight years ago, Sir Francis Head wrote the description of the North Western Railway from which we have already quoted, among the things that especially impressed him he mentioned the large and spacious carriage and wagon shops that occupied what was then known as "The Field" at Euston. The shops have long disappeared, crowded out by the ever-increasing traffic, which is now so far in excess of the accommodation, that in the height of summer there is no room even to marshal and make up the trains, or to wash and sweep out the carriages, and trains have to run the eleven miles to Willesden Junction and back to perform their toilette. In the first week of August, when the daily number of saloons on the Scotch trains may be counted by the dozen and the number of sleeping berths by the hundred, this toilette is no small matter, and the laundry at Willesden, where sheets and towels and so forth are washed, has to work double tides.

How elaborate indeed are the arrangements of a modern carriage-cleaning shed, the outside public has probably little idea. At Willesden, for instance, between the different lines of carriages are solid brick-built platforms on which the cleaners stand. Down the centre of the platform run tanks, whence the men with mops and brushes can take up the water that they need. At intervals there are hydrants, with flexible hose attached for filling the cisterns of the ever-increasing number of lavatory compartments. Alongside are taps which deliver the shale oil gas from the adjacent works into the reservoirs beneath the carriages at a pressure of some 100 pounds to the square inch.* Between the rails,

* At the Milan International Railway Congress the engineer of the Paris and Lyons stated that he had economised £4000 a year by connecting the taps of the gas-jets with the "night caps" of the carriage lamps, so that, when the cap is drawn over the glass, the gas is turned down to a mere glimmer. I am surprised that no English company has adopted this very simple and unobjectionable economy.

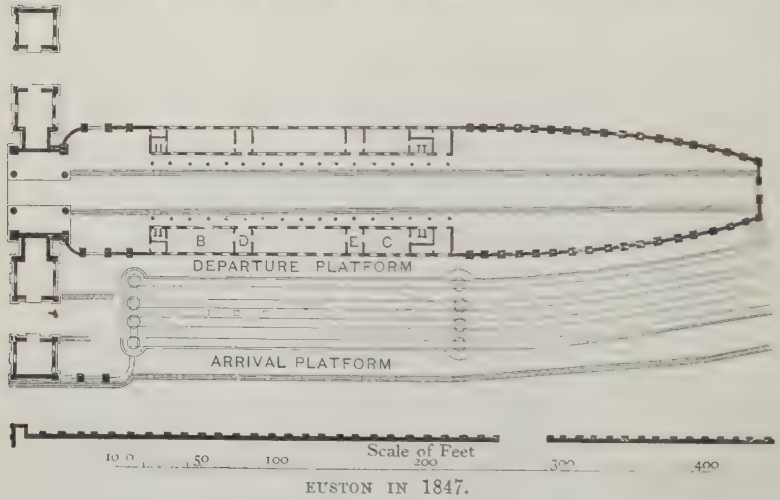
"pits," as they are termed, are carried the entire length of the shed, that so the brake mechanism and the gas pipes, the bearing springs, and the buffer springs may be easily accessible for inspection and repair. As might be expected, the sulphurous atmosphere of the "Underground" is fatal to the white paint of the North Western. So in the last few years this colour has been abandoned for the Mansion House trains, and the carriages are painted in chocolate throughout; they are cleaned, moreover, no longer with soap and water, but by being rubbed down with rags that have been moistened with a few drops of paraffin. This is found to have a good effect in preserving the paint.

The Company have lately bought enough ground adjoining Euston to enable them to double the area of the present station. A considerable portion of the site was formerly a churchyard, which was used for burials from the year 1620 down to as recently as 1859. The whole of this cemetery to a depth of fifteen feet has now been bodily (one has no wish to jest on such a subject, but the word is indispensable) removed to Finchley. All the time this operation was being carried on by the contractor, a doctor and an inspector were constantly present at either end on behalf of the Company, to see that nothing was done which might offend against either due reverence for the dead or due regard for the health of the living.

But it is owing to good luck rather than forethought that the space at Euston has sufficed as long as it has for the needs of the traffic. The original London and Birmingham terminus, though its magnificent expanse almost struck our grandfathers speechless with astonishment, occupied only a small portion of the present site. The traveller approached, as he does still, between two buildings. "The eastern," writes Mr. Bourne in 1839, "forms the hotel: on the western side is a coffee-house with apartments for lodgings."* Then

* Both buildings are hotels now, but I am given to understand that the *clientèle* of the eastern wing is even now of a more select description than is to be found on the western side of the archway.

he passed under the "magnificent propylæum, with columns higher than those of any other building in London," and through the great gates cast by Bramah (of latch-key fame). The works were admittedly stupendous, but then it had been rightly felt that "the national character was involved in the execution of the whole." Arrived beneath the "peristyle," the great hall, with its statue of George Stephenson and its fine staircase, leading up to the pillared entrance of the shareholders' room, as yet was not: and the whole of the ground to the left hand, which had been destined for the



EUSTON IN 1847.

accommodation of the Great Western Railway, where now are the "outwards" parcel offices and two departure platforms, was as yet unbuilt on.

At the earliest possible moment the Company took all needful precautions to protect the first-class passengers from the objectionable contact with those of the second class. According to Mr. Bree,* "travellers of the first class enter the office by the left door, and, after procuring their tickets, pass through the corridor E to the waiting-room C. Those of the second class enter the office by the other door, and

* BREE'S *Railway Practice*, 4th series, London, 1847.

pass through the corridor D into the waiting-room B." These waiting-rooms were on what is now the right-hand departure platform. Beyond this were two standing lines for empty carriages, and then the single arrival platform, now known as "No. 1." And here the station ended, though where now No. 2 and No. 3 arrival platforms, with the carriage roads alongside, and the "inwards" parcels office, and the parcels post office, stretch right across to Seymour Street, there were the carriage shops occupying a portion of "The Field," of which Sir Francis Head speaks. Mr. Bree says nothing of the third-class passengers, and shows no accommodation for their reception in his plan. No doubt they stood about in the peristyle and on the platform till their tubs were ready for them. Their number was not sufficient to inconvenience the officials, and of course no third-class train left the station at an hour when decent people were likely to be about. "As soon," to quote Mr. Bourne once more, "as the carriages are connected with each other and the passengers seated, the train is pushed forward by the porters to the bridge under Wriothesley Street." Then the rope was attached and the signal made by compressed air to Camden, and so, the stationary engine being set in motion, the train was drawn up.

The new extension will probably be ready some time in 1890. Meanwhile the traffic has to be worked as best it may with the existing accommodation, but, however severe the strain may be, and during the first week of August undeniably is, probably there are not many even of the most experienced travellers who could truthfully assert that they ever saw the station staff at Euston in a flurry, or ever knew a train steam away from the platform a moment after time. At 6.30 P.M. the work of the evening commences with the Dublin North Wall boat train. Five minutes later it is followed by a special horse-and-carriage train which picks up *en route* saloons and engaged carriages for the Highlands, and so relieves the later train. From 6.35 to 7.55 there is a lull, interrupted only by the Birmingham

express at 7 and local trains at 7.10 and 7.40. But then the rush comes fast and furious. The 7.55 runs through unbroken all the way from London to Stirling. Eight o'clock sees another Scotch express off, this time for Glasgow, Greenock, and Stranraer, as well as for the Highlands. Then, after twenty minutes' breathing space, goes the 'Wild Irishman' for Holyhead and Kingstown. And now our time is running short, for we are going down by the 8.30 postal train, the only mail train pure and simple in Europe, since even the Indian mail now carries through passengers between Brindisi and Calais.* But we have time to notice the 8.40, known as the 'Old Limited,' another special for the Highlands only, whose passengers, '*sua si bona norint*,' would be even more numerous than they are. For in the working instructions in reference to this train is a welcome order: "Perfect quiet must be kept at all stations where this train stops." † At 8.50 goes the 'Limited,' shorn now of its former greatness, since it admits an unlimited number of third-class passengers, but making up in quantity what it lacks in quality, as it is probably nowadays one of the heaviest expresses in the world, and runs between Preston and Carstairs with somewhere about 20 coaches each morning. At nine o'clock follows the Birmingham express, with parcel vans in addition for Manchester, Liverpool, and Carlisle. At ten comes the last of the true Scotch expresses, bringing the supplementary mails for Aberdeen, and carrying in addition parcel-sorting vans for Holyhead and Merthyr and so serving off this train almost the whole of Wales.‡

* [In America, where the Post Office carries "second-class mail matter" at nominal and entirely unremunerative rates, there are several special postal trains. 1899.]

† This was the arrangement in August, 1887. Last summer, however, the 8.40 P.M. did not run, as it had been found that the chief pressure came earlier in the evening In its stead the 8 P.M usually ran in two portions during the height of the season.

‡ Since last summer the midnight train, which is properly intended to serve Liverpool and Manchester passengers, has been so much improved to the North, that it also may now almost claim to rank as a true Scotch

But long ere this we have betaken ourselves from the glare and bustle of the departure platforms to "No. 1 arrival," where, beneath the dim light of the half-turned-down gas, huge red post-office vans are disgorging their contents in sacks and hampers into the yet huger sorting tenders of the postal train. Entrusting his bag to the guard, who was not a little startled at the sight of a mere passenger, the writer stepped on board and presented to the travelling superintendent a permit with a dignified seal attached that authorised this audacious invasion of his domains. The vans have no sooner discharged their contents than they move off, and by the time we are due to start and the guard blows his whistle, the platform is well-nigh deserted, the *nonchalance* with which the few officials who remain turn their backs on us as we steam out forming an amusing contrast to the *empressement* of the porters and ticket-collectors, and the frantic shaking of hands and waving of handkerchiefs which had just been witnessed on the further side. One might have expected (remembering that till quite recently the mails were run on a passenger train) to find the postal train a small one. But this was far from being the case, as it consisted of nine 42-feet vehicles (reckoned in the guard's journal as 13½) with a total length of fully 120 yards. The Company sent a parcel van for Manchester and a brake at either end, but the rest of the train was composed of post-office vehicles through which there ran a continuous passage.

In front were two parcel vans, the one for Edinburgh, the other for Aberdeen, in which men were sorting from and into huge hampers the parcels that had been roughly grouped by districts at the London receiving offices. In the rear of the train was a similar van for the Glasgow parcels. In all,

express. [The Scotch passengers now go separate at 11 50 P.M. on a train which runs from Euston to Carlisle, 300 miles, in 10 minutes under six hours, with only one intermediate stop. Most of the other trains mentioned in the text have been altered, rearranged, and duplicated, and some wholly new trains, such as the 10.15 P.M. Irish Express, have been added. 1899.]

we had "on board" about 3000 parcels in 100 hampers and packages. On the whole, the parcel-sorters had a comparatively easy time of it. It is true that occasionally a parcel would give a good deal of trouble. We had one, for instance, for Port Hamilton that caused great searchings of heart, as it was only stamped at the inland rate. One man thought Port Hamilton was in Newfoundland, a second was almost sure it was in the Baltic—at least he knew there had been

PICKING UP A BAG AT HARROW.

some talk about it recently in which the Russians were mixed up. Finally the superintendent decided that the parcel should go to Liverpool, and that the authorities there should adjudicate upon its ultimate fate. But the train only stopped at Rugby and at Tamworth all the way from Euston to Crewe, so the parcels to be dealt with were a finite quantity, and, if those to go out at Rugby were ready by the time the train reached Blisworth, the sorters could sit down and rest for twenty minutes.

The labour of the letter-sorters, on the other hand, was like that of the Danaides, as the letters poured in and out all the way in a never-ending stream. In the middle of the train were three letter-vans. In the centre one was worked the "apparatus" which took in and put out the letters. On either side was a sorting van, the one going through to Aberdeen, the other to Glasgow. Hardly had we got clear of London, when at Harrow we received our first consignment of letters. As we approached the station the official in charge of the apparatus drew back a sliding panel on the left-hand side of the carriage. Then, with a lever (not unlike a signal lever) placed lengthways of the train, he thrusts out at right angles an arm with a net attached that had hitherto been lying tight folded against the side. The motion of the lever sets an electric gong ringing furiously, and warns all concerned that the net is out and it is not safe to attempt to pass across the opening till the letters have been received. Crash! a shower of sparks flies from the iron arm, the train seems for a second to reel from the shock. Bang! and a great leathern bundle, or "pouch," as it is technically termed, falls with a dull thud upon the floor. Formerly the pouch remained in the net and had to be pulled in—no easy task, if, as is sometimes the case, four or five were picked up at one station. Latterly, by a recent improvement in the apparatus (which, after nearly forty years' progress towards perfection, now seems to leave little further to be desired), the net catches the pouches obliquely, and then the force of the collision causes them to rebound off it straight into the carriage. The present writer was standing and watching the operation within a few feet of the opening. "You had better," said the official, "move a little further off; it was only a week or two back that a pouch flew up and broke the lamp glass just over your head." I obeyed without discussion.

Certainly if anyone wishes, without experiencing one, to know what a collision at fifty miles an hour means, he should feel the shock caused by four pouches weighing perhaps two

hundredweight and then imagine what it would be if that were multiplied by 2000 to arrive at the weight of an ordinary train. The pouches are of the thickest and toughest hide, bound round with straps hardly slighter than the traces of a set of carriage harness, and they are suspended to the post whence the net sweeps them off with fastenings of iron as thick as a man's finger. And yet scarcely a night passes in which three or four pouches are not crippled, the iron snapped short off, or the buckles of the straps torn right out of the stitching. Mails are put out much the same way as they are taken in. They are wrapped up in a pouch and hung out from an arm on a level with the footboard of the carriage and caught by a net only a foot or two above the level of the ground. At most stations bags are put out and taken in simultaneously.

It is rather remarkable that a method which has been in operation in England, and also in the United States, for more than a generation, and which is now as much a part of the every-day arrangements of our Post Office as pillar letter boxes, should never have been adopted in any foreign country. A beautiful little model of two travelling post offices as run on the postal train, with nets and apparatus all complete, was, however, made in 1888 at Wolverton, and despatched as a present from St. Martin's-le-Grand to the office in the Kaiserstrasse, as Herr Stephan was understood to be contemplating the introduction of the system in the German Empire. There is, however, one difficulty which, as it may not have been foreseen, is worth alluding to. Is it quite certain that all the German mail trains, those of Würtemberg for instance, run fast enough to cause the apparatus to work with its accustomed regularity?

"But how," I asked—and my readers will doubtless be inclined to ask the same question—"do you know in a pitch-dark night, possibly in a dense fog, when it is time to let down your apparatus?" The answer was that everything was done not by sight but by sound. With a thorough knowledge of the ground and of the speed of the train, a

practised ear can tell at any moment what point has been reached. The hollow reverberation of the water-troughs between Pinner and Bushey no one could fail to recognise. North of Watford a tunnel forms the "mark" for Tring; approaching Nuneaton the "mark" is unmistakable. We have hardly passed through an arch under a wide roadway, when a bridge over the canal rings under our wheels, then comes the echo of another arch above us. Out goes the net, and in come tumbling the Leicester, and Coventry, and Nuneaton bags. Not long since these same Coventry bags caused no small trouble to the Post Office authorities. The Coventry watchmakers send watches all over the country in registered letters, and the rough shock of the apparatus was found somewhat trying to their tender constitutions. The rule has accordingly now been established that no packet marked "fragile" shall be sent in mails picked up by the travelling offices.

The pouches are no sooner on board than they are hastily opened, the bags extracted and unsealed, and their contents transferred to the sorters in the adjoining carriages. The sorting does not differ very materially from that which may be seen any day at the General Post Office. The same process of facing, stamping, and sorting into innumerable pigeon-holes goes on in both places at a speed that to an outsider seems almost miraculous. The pigeon-holes are all labelled with the names of places, but every clerk has his own system of sorting, which he always adheres to, utterly regardless of the names that it may have pleased some other person to affix. As each pigeon-hole becomes full, its contents are tied up in a bundle and transferred to the proper mail-bag, which with forty or fifty of its fellows is hanging, swaying gently to and fro with the motion of the train, upon the row of pegs on the wall behind the sorters' backs. At one end of the carriage, with the counter and pigeon-holes in front of him separated from the rest by a wire screen, is a clerk whose special function it is to deal with registered letters. His duties as a sorter are light enough, but he fully

occupies his leisure with the preparation and collection of innumerable receipts and the filling in of the complicated but necessary returns.

A travelling sorter, however, besides the quickness of hand and eye and the knowledge of geography that the ordinary sorter needs, requires to have a special knowledge of the working of the train. Otherwise he would be apt to be puzzled if, as he was hurrying northwards fifty miles an hour between Rugby and Stafford, he was presented with a batch of letters just taken on board for stations lying south of Rugby. Or, again, he might well ask why he was troubled with Dublin and Belfast letters, when the Irish mail was careering along seven or eight miles in front over the same metals. Or he might wonder how letters for Norwich or Bristol came his way. But all his difficulties would be got over when he came to learn how the service fitted together and interchanged with other mails, till he would gradually find that the superintendent's boast was a true one, and that there was hardly a place in England north of the Thames that could not be served off this single train.

We reach Tamworth at 10.55, and there from the Midland line, which at this point passes over our heads, we take in hamper after hamper of parcels, and sack after sack of mails, which Midland trains have brought from Plymouth and Bristol on the one side, and from Lincolnshire and the Eastern Counties on the other. What we have to put out is, of course, less, but still the bulk is considerable. Five minutes is all the time allowed, but, let the men work as hard as they like, only one hamper can get out of a door at once; so it is two minutes past eleven before we are under weigh once more. "What about the Birmingham mails?" we ask, as half an hour later we whiz through Stafford without slackening speed. At Crewe we learn the answer. The 'Irishman' has stopped at Stafford and picked up the Birmingham bags, and here it is waiting to transfer them to us, and to receive from us in return all the Irish and North Wales letters that we have collected and sorted on our way

INTERIOR OF POSTAL SORTING VAN.

down. The postal train, after putting out the London letters which it has received by means of the apparatus, to be called for in an hour by the up mail, and also its Manchester mails, proceeds on its way north to Preston and Carlisle.

We have then to make acquaintance with a train which, though at present standing humbly on a siding, is undoubtedly one of the most highly connected trains in England. Starting from Holyhead at 8 o'clock, it has brought mails flowing in from every small stream in Wales, to empty them into the great reservoir at Crewe. From Crewe it will set off again, not only with mails from every part of England, Wales, and Scotland, for Manchester, Sheffield, and the Yorkshire towns, but also with the proud burden of a special "sausage van from Dudley to Leeds." To trace its progress across the maze of lines, through Lancashire and the West Riding, would require a chapter to itself. Suffice it to say, that at 2.28 A.M. it finally expires at Normanton in the arms of the North Eastern, the Lancashire and Yorkshire, and the Midland.

It would be tedious to enumerate the trains that pass through Crewe in the four hours before and after midnight in the tourist season. Let us just say that all the trains that are noted above as leaving Euston have to pass through Crewe, and that they are supplemented by the Salop mail, the Birmingham mail, the North Stafford mail, as well as one of the new Severn tunnel expresses. Meanwhile a long train of Grimsby fish for Hereford and the west is balanced by a heavy load of Worcestershire vegetables on its way to the Manchester market. But the window blinds are closely drawn down, and the carriage lamps have got their nightcaps on; so, though the locomotive staff are busy enough, the work of the traffic department is comparatively light.

To see Crewe Station really busy, it should be visited, not by night but by day, say between 1 and 3 P.M. any day during the first week in August. Here is the contingent

that was despatched from Euston in the summer of 1888:—

Departure	Destination.	Due at Crewe.
9 A.M.	Dublin (North Wall)	1.31 P.M
10 A.M.	Edinburgh	1 P.M.
10 3 A.M.	Glasgow	1.15 P.M.
10.10 A.M.	Manchester and Liverpool	1.41 P.M.
10.30 A.M.	Perth	1.50 P.M.
10 40 A M.	Lakes and North Wales	2.10 P.M.

The 10.40 A.M. is put down as one train. In fact, for many weeks the Lakes and the North Wales portions were worked as two separate trains, and indeed on several occasions the train ran in triplicate. Nor is any mention made of the 11 A M. Cambrian tourist express, *ex* Euston, for that train has to do a great deal of roadside work, and only reaches Crewe at 3 o'clock. All the trains given above are practically through trains from London to their respective destinations. Nominally some of them may be booked to attach carriages and pick up passengers at intermediate stations. But what may be possible in June is wildly impossible in August. Here are one or two specimens of the local traffic as I saw it on August 1st. Birmingham was booked to send a train arriving at 12.32, and Leicester a second due at 12.40. These two should have united at Crewe, and formed two fresh trains, the 12.47 for Blackpool, and the 12.50 for the North Wales coast. In fact, Leicester—which means (it should be said) Leamington, and Coventry, and Nuneaton as well—sent on its own account a heavy train for North Wales, and then another for Blackpool. As for Birmingham, its portion came in with "20 on," including through carriages from Burton, from Nottingham, both *viâ* the Midland and *viâ* the Great Northern, and from Derby as well as from Birmingham itself. Needless to say, this formed a third independent train. The 10.40 from Euston should have taken forward more through carriages from Birmingham to North Wales, but that morning the two halves of the 10.40 had thirty-

three carriages on their own account, so Birmingham once more had to be "specialled" independently.

On this latter train, the last that need be noticed, though the tale is not half told, went forward a through carriage from Newport in Monmouthshire to Penmaenmawr. It was run for the special use of half a dozen third-class passengers. The French railways also are obliging enough to put through carriages at the disposition of their customers. The Nord, for example, will supply one for any distance under 32 miles for £4, or say 4s. a mile, the average earnings of an entire English passenger train: for longer distances it is content with a minimum of 16 first-class fares. No wonder the British public is discontented and writes to the *Times*. Not that all are so, however; I saw one

"Ingenui vultus puerum ingenuique pudoris,"

aged 14, with his cap well on the back of his head, step out jauntily on to the platform. Thrusting his hands into his pockets, he looked round in a condescending manner, and then remarked to the expectant listeners, "Tain't a bad station this." But youth is generous rather than just. The true *nil admirari* attitude of the British public was better typified by a gentleman who came up to an inspector to whom I was talking. A fresh engine had just hooked on to his train, and was blowing up the vacuum, with a sound, it must be confessed, by no means soothing. "That man ought to get twenty years' penal servitude," he fiercely exclaimed; "all this noise is perfectly unnecessary." Very civilly the inspector explained that the air must be exhausted from the train pipe before the driver could obtain control of the brakes. I hazarded the suggestion that it might be as well also to put out the fire lest it should smoke, and the tourist turned away silent but unconvinced.

And now I am going to have a grumble on my own account. Last August, passengers for Edinburgh left Euston at 10, and reached Crewe at 1. Those for Dublin left Euston an hour earlier, and reached Crewe half an hour later.

Compared with the state of things a couple of months before, the Scotch train was 18 minutes faster, and the North Wall train 43 minutes slower. And yet the Irish traffic must be worth to the North Western eight or ten times as much as that to Edinburgh. It surely ill becomes a great and liberally-managed line like the North Western to let it go forth to the public that, while they are prepared to move heaven and earth where traffic is competitive, they will not stir one finger merely for the sake of their passengers' convenience.* Apart from the fact that a departure as early as 9 o'clock must be most inconvenient for passengers who have to come from the further side of London, a run of 158 miles in 4½ hours, or a speed of little over 34 miles an hour, though it could undoubtedly "give fits" to the "Cannon Ball Train" which takes an hour and a quarter longer over the 6 miles less distance between Atlanta and Chattanooga, is not what we in England expect from a through train on a main line.

It is the more remarkable that the Company should condescend to this unworthy speed, as in all other respects their Irish services are above criticism. If anyone wanted a text on which to hang a homily on the baleful effects of Governmental subsidies, he could hardly do better than go to Holyhead. There he would find that the heavily subsidised City of Dublin Steam Navigation Company runs two services a day for first and second-class passengers only from the Admiralty Pier. Four out of its five boats are twenty years old, and, till the Company's supineness almost lost it the contract a few years back, they had remained unaltered for a whole generation. Alongside, the North Western, which, as far as its steamboat service goes, is, of course, entirely unassisted, has spent in the interval some three millions sterling in the erection of a splendid range of warehouses and wharves and docks, and the creation of an entire fleet of over twenty steamers. The best of them are now almost as fast, and were, till the launch of the 'Ireland' and the overhaul of the engines of the 'Leinster' and her fellows,

* [See Supplementary Chapter. 1899.]

a good deal faster than the mail boats themselves. And, even now, the 'Banshee,' which was ordered on the faith of a Government contract that was subsequently withdrawn, can hold her own with the best of them, though she is no longer what she was before the 'Empress' and the 'Princess Henriette' were built—the fastest cross-channel steamer afloat.

But the Kingstown and the North Wall boats, though close together in point of speed and not very dissimilar in size, are worked in a very different manner. The mail boats carry little but mails and passengers, while the North Western brings over butter and fowls enough to feed half London and leave a good supply for Liverpool and Manchester as well. As for cattle, there are steamers that do nothing but run to and fro for this special traffic: and, if the cattle are not quite as comfortably accommodated as the passengers in the luxurious saloons of the 'Lily' and the 'Violet,' at least their quarters are much superior to the farm-buildings that they have left. Most questions have two sides. When that of the Irish mail contract was to the fore a year or two back, the common account of the matter was that the rich and grasping English Company was endeavouring to rob its poor Irish brother of his single ewe lamb. Holyhead, however, tells another tale, and asserts that, while nine-tenths of the £1,000,000 capital of the City of Dublin Company is held in Liverpool,* Irish investors are shareholders in the North Western to the extent of three millions.

And now for a word as to goods trains, and an attempt at an outline sketch of the process by which the produce of the country, and indeed of the world, is concentrated on to the great highway leading from Rugby to the Metropolis.

* Holyhead is, however, mistaken. I am informed on indisputable authority that only a few hundred pounds of the City of Dublin Company's stock is, or ever has been, held in Liverpool, and that by far the larger part is held in Ireland. Everyone must be glad that a service which, when all is said and done, is distinctly a fine one, should be placed to the credit of Irish management. Let us hope that before long a few more Irish land services will be levelled up to the speed at present attained across the Channel by the 'Ireland' and her consorts. [The City of Dublin Company's improvements of recent years are as creditable as those of the North Western itself. 1899.]

CHAPTER III.

THE NORTH WESTERN RAILWAY.

GOODS TRAFFIC.

"NEVER in the history of overland travel has there been such a blockade of freight on all lines as at present. The Central Pacific is two weeks behind time in freight shipments. The Southern Pacific has fully one month's freight side-tracked at various points. . . . but the Atchison Road is in the worst dilemma. . . . They are using every locomotive to transport passengers; and freight is thus tied up all along the line. The Atchison Company is feeding hundreds of passengers at Kansas City until they can get seats on a West-bound train. As a rule, it requires three days at Kansas City before accommodation can be secured by those who buy tickets there." So wrote the New York *Tribune* not long since, describing in its matter-of-fact style a state of things that, to the average Englishman, who grumbles if, on a Bank Holiday, he fails to find a square seat on which to deposit his travelling-bag, would probably give thoughts not only too deep for tears, but too serious even to be relieved by a letter to the *Times*. "But this," it will be said, "is exceptional," and so of course it is; and in ordinary times, and on the older roads, shippers may, no doubt, count on having their goods forwarded at a steady jog-trot, twelve or fifteen miles an hour, with reasonable certainty. But, before we come to compare this state of things with our English goods traffic, let us cast one brief glance at the conditions prevailing among our chief Continental rivals.

According to the French law, goods delivered to the rail-

way company in Paris on Monday can, as a rule, be claimed by the consignee, say in Calais (184 miles), the following Friday, goods carried at the highest rates and live animals one day sooner. If even this celerity is not satisfactory to the public, they may send their goods or their cattle by passenger train, but for this they will have to pay three times as much as the highest goods rate. If, on the one hand, it is said that the companies do not usually occupy the whole of the time legally allowed, on the other it is alleged that they deliberately make it unnecessarily long, in order to force as large a proportion as possible of the traffic to pay the exorbitant *grande vitesse* tariff. In Belgium and Holland the conditions are similar to those in France; in Germany the time allowed by goods train is much the same, but the charge by passenger train is only double, except by express, and then it is four times the ordinary tariff. And now let us come to England.

Celerity in goods traffic seems to have been a special feature of English railway management from the very first. As long ago as 1843 the Liverpool *Times* recorded that 200 tons of merchandise were handed to the Grand Junction at Liverpool on Saturday afternoon, and delivered nine hours later a hundred miles off in Birmingham. Speaking broadly, it may be said that the whole English goods traffic is nowadays organised on this basis—that the railway receives the goods from the consigner the last thing at night, and hands them over to the consignee the first thing next morning. A Manchester warehouseman, for example, goes on 'Change in the middle of the day, and sells grey shirtings for the China market. When the day's business is over, at six o'clock or thereabouts, his own or his agent's carrier delivers the goods to the station, or it may be that the Company calls and fetches them. By seven o'clock the cotton is at the station. By eight o'clock it has been loaded on to the railway trucks. It starts at once on its journey, and reaching London, which is, roughly speaking, as far from Manchester as Paris is from Calais, between five and six next morning, is unloaded with

the same celerity, and the dray is at the ship's side in the docks before the London agent has reached his office to open the letter giving notice of the consignment. Or, to reverse the process, the Bradford woollen manufacturer attends the London wool sales, buys Cape or Australian wool, and then goes home to bed. At 7.15 next morning his wool reaches Bradford, and after breakfast he can set his hands to work to unpack the bales.

It might be thought that speed such as this was fast enough for anything; but that is not the case by any means. The warehouseman does not want his goods till eight or nine o'clock, but the Smithfield market is open to receive meat at 1 A.M., while Billingsgate is ready for its fish at 5. Accordingly, fast as the ordinary goods traffic is carried, the market traffic (as it is called) goes much faster yet. Danish butter which left Newcastle at 4 P.M., fish which was not despatched from Hull till 7, are unloaded alongside at Broad Street at 2.15 the following morning. Two hours later Broad Street sees a yet more remarkable train—to the best of the present writer's belief, the most remarkable goods train in the world—the "Scotch fish and meat." This train leaves Carlisle at 8.51 P.M., ten minutes after the 'Limited,' and half an hour in front of the 'Special Mail'; and this position between two fast expresses it maintains hour after hour all the way to Willesden, till finally it reaches Broad Street five minutes before the mails reach Euston; and by the time the postman's rap is heard at our doors, the butchers' carts from Smithfield and the fishmongers' carts from Billingsgate have distributed its load half over the Metropolis. Needless to say, a train like this consists entirely of vehicles fitted with spring-buffers, screw couplings, and continuous brake pipes, and is telegraphed in advance from point to point, exactly as is the case with an ordinary passenger express.*

* The history of this train is not without interest. In the seventies, when the 'Limited' was still what its name implies, third-class passengers left Glasgow at 4 P.M. and reached London at 5 next morning in company with the fish and the meat. When the 'Limited' became an ordinary third-

And this vast volume of traffic has to be crowded in within narrow limits of time. For example, out of twenty down trains from Broad Street, fifteen leave in the four hours between 7.27 and 11.20 P.M. And each one of these trains represents in itself an elaborate organisation. The 11.20 P.M., for instance, the last train out at night, takes trucks for nineteen different places, which, when they reach Camden Town, are broken up, and remarshalled to form portions of five separate trains. It is not as in passenger traffic, where the train goes through to three or four main points, and the passengers for the intermediate stations get out, and those for the branches change carriages at the junctions. The goods train has no time to stop for its trucks to be unloaded and refilled: it can only stay to "throw off" the loaded wagons and hurry forward. If at the points where it drops portions of its load there are no other loaded wagons waiting to take their place, the locomotive superintendent will cry out at once that his engines are required to run with only half a train behind them. And so, in steering between the Scylla of not delivering the goods by nine o'clock next morning and the Charybdis of extravagant working expenses for want of full loads, the traffic superintendent has by no means an easy task.

Let us look at the working of a single train, and as a good instance (though, doubtless, other companies besides the North Western could show specimens as good) we will take the 7.45 P.M. "Express goods" Leeds to London, which begins its career by running over the forty miles between Leeds and Manchester, which is possibly quite the most crowded bit of

class train, the 4 o'clock was left practically without passengers, and after a few years it died, as far as "Bradshaw" is concerned, of inanition. It still survives, however, in the working book for the benefit of the fish and meat, with which (when there is any to carry) it runs in the times given in the text. It would be interesting to know what the *Chef de l'Exploitation* of the Paris and Lyons Railway would say, if it was proposed to him to turn his passengers out of the Marseilles *Eclair*, and then accelerate it some five miles an hour, in order to gratify the Parisian appetite for fresh *bouillabaisse*.

railway in the world. On the road it only stops six times, and it reaches Broad Street before six o'clock.' In Yorkshire it makes but one halt, and that for thirteen minutes; but in the time it attaches traffic that has come by five different trains from five different West Riding towns. Thence it passes on into Lancashire, and a pause for ten minutes at Heaton Norris, outside Manchester, suffices to pick up traffic that has come by four more trains from four more important towns, and also that which has been gleaned by a stopping train at all the roadside stations along the line by which the express itself has come. From this point to London the stoppages of a few minutes apiece are "for locomotive purposes only." I obtained the record of the working of this train for three weeks in succession last summer, from which it appeared that in that time it was only once more than five-and-twenty minutes late, against which may fairly be set off the fact that one day it arrived half an hour and another fifty-five minutes before its time. This is not the place to enter upon the vexed question of railway rates; but one remark is obvious, that for English merchants to complain that our goods rates are higher than those on the Continent is much as if a gentleman were to expect to keep a barouche and a pair of horses for one pound a week because his neighbour found that sum ample to pay for his basket pony-trap.

But the high pressure at which the goods traffic is worked is not more apparent in the speed at which the trains are run than in the celerity with which they are loaded and despatched. Passengers from London Road Station in Manchester must have noticed that to reach the platform level from the street they mount a sharp incline. Entering the station, however, where nothing so vulgar as a goods wagon is anywhere in sight, it would hardly occur to them to think that they were standing over one of the busiest goods depôts in the world. But so in fact it is. It would be a very slack day on which London Road did not deal with nearer two thousand than one thousand tons of merchandise of one sort

or another. Let us descend the steps at the side of the station and see for ourselves how it is managed. It is eight o'clock in the evening, the clerks and the shopmen have mostly gone home to their suburban dwellings, and the passenger station has already begun to look half asleep. Downstairs, however, the rush of the outward traffic is at its full height. The goods depôt consists of a series of wide arches running crosswise, supporting the platforms and the rails above. Through each arch there runs in the centre a platform or "bank," as railway men call it, with on the one side a line of rails, on the other side a road.

When we arrive the roads are filled from end to end with rows of loaded lorries, and the railway lines with rows of empty trucks. At intervals of two or three trucks' length along the "bank" stand hydraulic cranes, each crane with a weighbridge beneath. We pause opposite a lorry loaded with some forty huge packing-cases *en route* for China. In an instant clamps are affixed to the topmost case; the crane, if one may pursue the metaphor, elongates its neck, then turns its head to one side, and gently sets down its burden on the weighbridge. In far less time than it takes to tell the tale the weight is recorded, the crane has again caught up the case in its iron bill, and with another turn of its head deposited it finally in the railway truck. And so the work goes on, four cases a minute swinging across from lorry to truck, only stopping to register their weight as they pass. In ten minutes the lorry is empty, the truck full—the horse draws on with the empty lorry; but what of the truck? The Company has neither engine nor horse in sight. Before we have time to ponder, a rope is hooked on to the truck and turned round a neighbouring capstan. The shunter presses his foot on a block and releases the hydraulic machinery; the capstan spins round, and the truck is drawn forward. At the end of the arch (or "run," to use the technical term) it is stopped on a turn-table, and, a rope from a second capstan being attached, it is turned round, and then with a fresh impetus sent flying forward again till it runs on to a

huge lift. Again its course is checked for a few seconds, till the lift—this too worked by hydraulic power—has had time to rise to station level, when by a fresh series of capstans the truck is dragged off and dismissed to join the train that is "marshalling" on an adjacent siding. In this way eighty or ninety trucks are loaded and got rid of in an hour.

The consignments lying on the "banks" are amusing in their diversity. Here, in one lot, are twenty tons of grey shirtings for export from Southampton. Alongside is a kitchen fender and a hip-bath, without even a sheet of paper to cover its nakedness. A little further on, lying on a heap of straw that has covered some solid machinery castings, and overshadowed by huge bales weighing 24 cwt. apiece, we come upon a railway rug done up in a strap, with a racket and a pair of tennis-shoes tied on. At eight o'clock the place rang on all sides with the "sweaty haste" of the workers, and to an outsider it looked as if they had a week's work prepared for them. But by ten o'clock the lorries are emptied and gone, and the last finishing touches are being put to the trucks in a deliberate manner, which implies there is plenty of time to spare. It has been a slack night, the superintendent declares; had he known beforehand, he need not have put on so many hands. London Road can now doze off till two or three o'clock, when the goods from every quarter of Great Britain will pour in to keep the place alive, till at eight or nine o'clock the passenger traffic gets into full swing again. Then for the rest of the day the goods traffic, in the expressive Yankee phrase, has to "take a back seat."

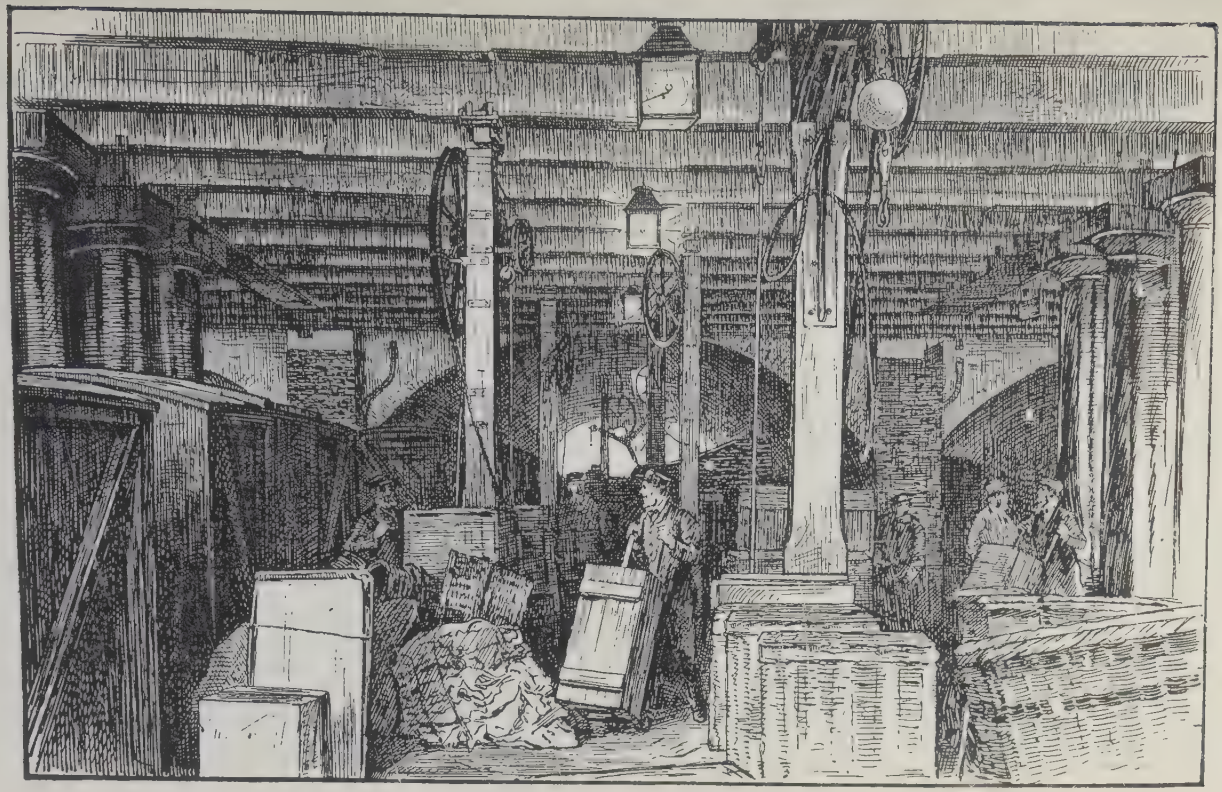
Manchester is a large town, of course, and in perfection of mechanical appliances for dealing with goods London Road can hold its own with any station, but for variety of traffic it is nowhere in comparison with Broad Street. Broad Street, in the well-rounded but well-founded boast of its *genius loci*, is "the largest goods station in the largest city in the world, and it belongs to the largest corporation

in the world."* If, in the face of this magnitude of three dimensions, our pen falls short and fails to rise to the "height of this great argument," we trust we shall be thought not all unworthy of forgiveness.

At the first glance Broad Street Station looks much the same as London Road, except that it is on a larger scale throughout. As at Manchester, the goods station consists of a series of "runs" carried through the arches under the passenger station, and therefore at right angles to the passenger platforms. But there is a difference characteristic of the difference of the trade of the two places. Speaking broadly, Manchester only consigns goods directly to the outports, to London, and to the towns in its own neighbourhood; and these are a finite quantity. London, on the other hand, trades directly with every town in the kingdom. The subdivision is, therefore, too great for it to be possible for the vans to draw up as at Manchester, each opposite the row of trucks for which its goods are destined. Accordingly the goods are delivered on to the "bank" at one side of the station, and thence wheeled away on barrows to the train by which they are to be forwarded. Each "run" contains two trains, one on each side of the "bank," instead of a train and a cart road, as is the case at Manchester. And here comes in one of the problems with which the railway manager perpetually has to contend. "The more often you handle your goods, the heavier will be your working expenses," is a cardinal maxim of railway policy. On the other hand, goods for Leeds or Liverpool must evidently be loaded and got away early, long before goods for Oxford or Rugby need be despatched, otherwise they will be too late for the first delivery next morning.

The public not being so obliging as to send in its Liverpool stuff at seven and keep back the "short norths," as they are termed, till nine, the unfortunate inspector is con-

* [This may have been true in 1888. It is not so now. Both the Paris and Lyons and the Pennsylvania Railroad surpass the North Western in capital, in volume of traffic, and of course still more in length of line 1899.]

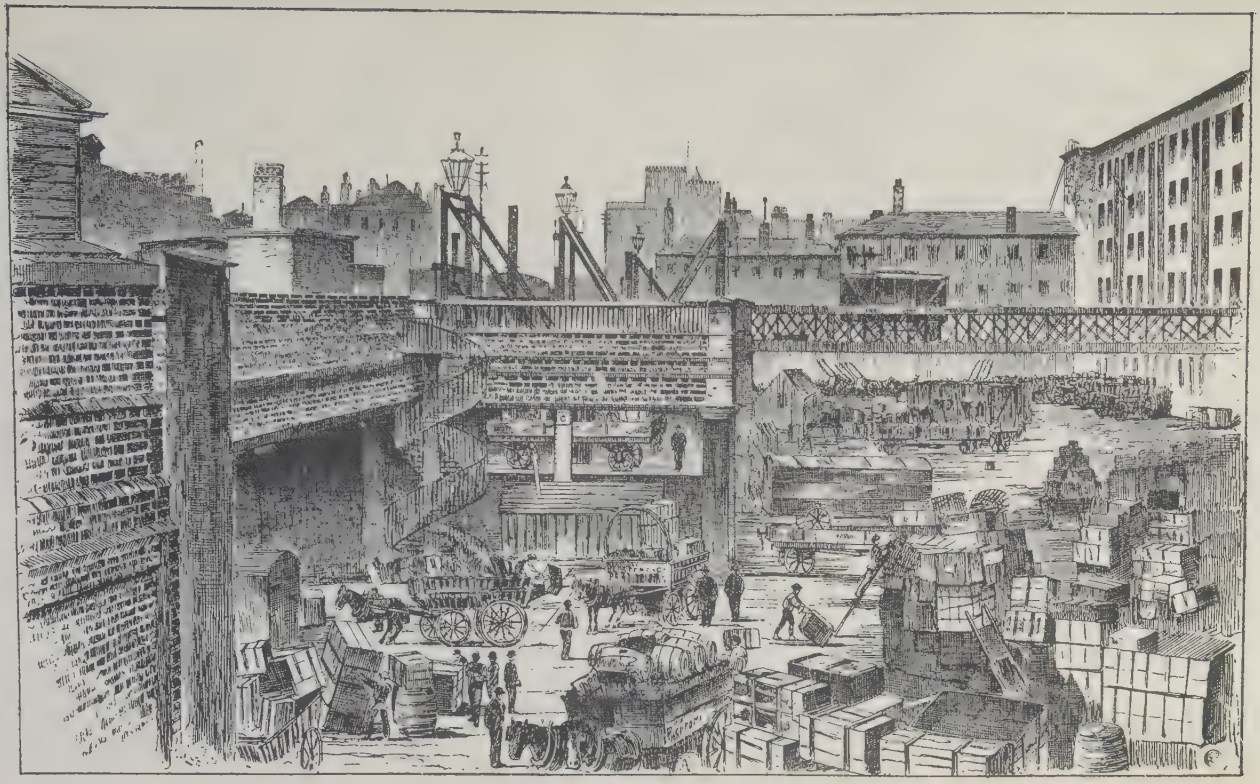


A "RUN" AT BROAD STREET.

stantly between two fires; if he leaves his Oxford goods lying where the van deposited them till he wants to load them into their train, he blocks the "bank," and the men cannot do their work; if he attempts to load for every place at once, instead of employing 300 men for four hours he needs 400 men for three hours; and this, as he is well aware, means extra expense. At the end of each "run" is painted up the name of the train that is loaded in it, and each truck as it is finished is despatched to the upper air by the same method that has already been described as in use in Manchester. It may interest those who are concerned with the conditions and prospects of East End labour to know that some years back the North Western employed a considerable number of casual hands taken on at so much per hour. But the temptation to the men to prolong their work over as many hours as possible was too strong for them, and, as the arrangement consequently conduced neither to efficiency nor to economy, it has now been abandoned, and all the men at Broad Street are the regular servants of the Company.

Passing out of the "runs," we come to a space which, in comparison with the low-browed arches we have left, is so open that it rejoices in the cheerful designation of "The Field." On one occasion we found "The Field" filled almost to overflowing with vast piles of empty cases, which our guide—mindful of the fact that, however many of them might come that way, the railway company at least got no profit out of them—not inaptly described as "wind."* Railway men have a knack of hitting out at times a happy phrase. "Birmingham feathers" is the latest addition to the Broad Street technical dictionary, the term being em-

* Alas! like many another open space in London, "The Field" is doomed. A rearrangement recently made will enable the Broad Street staff to get rid of their empties as fast as they receive them, instead of allowing them to accumulate as heretofore. The "wind" will sweep over it and be gone, and before long probably "The Field" will be roofed in and become a mere extension of the present goods station.



"THE FIELD" AT BROAD STREET.

ployed to designate the small iron scraps that, in the shape of tangled hanks of old wire, steel shavings, and so forth, make up some of the roughest and most awkward consignments that the servants of the Company are ever called upon to handle. On another occasion we noticed a very different state of things. There stood there five large vans, each containing five enormous rolls of paper. This we learnt was a two days' supply for one of the great London "dailies." It appears that almost all the newspapers get their paper from Lancashire, or in some cases from the north of Ireland, *viâ* Broad Street, and that in the railway warehouses there is always stored a supply sufficient for a fortnight's consumption, in case at any time there should be a break-down at the mills. If Carlyle could only have seen a whole archway filled with these "poor bits of rag paper" waiting to have "black ink printed on them"—not that by the way any large proportion of rags enter into the composition of the modern newspaper—still more if he could have climbed up, as we did, over the mountainous rolls and stood there with all their possibilities of wisdom beneath his feet, what a sermon would not the strangeness of his pulpit have suggested to him.

These immense rolls of paper require the utmost nicety in handling. The modern printing-press runs at such a tremendous pace that, unless the roll of paper is without a flaw, and unwinds absolutely true and square, it is liable in a moment to cause an accident. "At one time," said our informant, "we were always having complaints. We used to lift the rolls up with clamps to put them on the wagons. Then we tried passing a rod through the middle, but that pushed the edges out of the straight. Now we've got men who are accustomed to the work, and they sling each roll with a broad soft rope, and we never hear anything more about it."

But Broad Street is not content to deal only in "wind" and paper. On the contrary, its special distinction is the large proportion of "high class," or in other words profit-

able traffic. Of the fish, the meat, the butter, we have already spoken—we must just add that the dead-meat trade from Liverpool alone amounts to tens of thousands of tons in the year. Against this, which of course is all into London, may be set the truck-loads of tea and of silk (insured for £50 or £100 each package), the hundreds upon hundreds of crates and boxes of drapery goods, the train-loads of wool (in those months when the wool sales are on), which leave the great warehouses in the City every night for every part of the country. "What is your busiest time in the year?" I asked. "Just before Easter," was the reply. The reason, which does not appear obvious at first sight, is as follows:—Easter is the accepted time for the purchaser of "summer novelties" in the drapery line. But the country shops put off laying in their summer stock till after Lady Day is past, so that they may not have to pay for the goods till Midsummer. Consequently between Lady Day and Easter the traffic comes with a rush, and when Easter falls early the rush is almost overpowering.

The trade of London has, no doubt, many remarkable peculiarities; but there can hardly be many features more remarkable than this, that, though London probably does not itself manufacture one ounce of all the tens of thousands of bales of wool that are poured into its port, almost all of it is carted up from the docks to warehouses in the heart of the City, and then carted back to the stations on its way to the West Riding or the Continent. The same might be said of the tea, the silk, and produce of all kinds. Everything is consigned to London, nothing is consigned *viâ* London to the towns beyond. Much the same thing, though not perhaps quite to the same extent, takes place with goods for export. Manchester or Halifax goods may be taken by the railway companies straight through to the docks at Poplar or Millwall. But when they arrive there they are carted or lightered not direct to the ship's side, but to an adjacent warehouse, there to await the order of the manufacturer's London agent. It was perhaps the ignorance, or at least the neglect, of the

cardinal fact that only a very small proportion—it has been put at one-thirteenth of the whole by one very competent authority—of the trade of London is transit trade that has led to the disastrous failure of the Tilbury Docks.

It is not quite true, by the way, to say that the traffic in eatables is only into London. Broad Street despatches every day to Lancashire three or four truck-loads of what is known as "offal"—the heads and feet, the hearts and livers of the animals that are slaughtered at the Deptford Cattle Market. But this may perhaps be considered to be balanced by the fact that there is also a large "inwards" traffic in cats'-meat from Scotland. Why horses should die more freely in Scotland, or cats be more hungry in London, or why Lancashire should have a special *penchant* for tripe and trotters, is a sociological puzzle for which the Broad Street authorities have made no attempt to find a solution. They are satisfied to recognise the fact, and content if it bring some small accession of grist to the great North Western mill.

Let us notice one point more. In his recent lecture before the Royal Engineers at Chatham Mr. Findlay stated: "The staff of men and horses which this one Company alone employs in the collection and delivery of goods in London exceeds, I believe, the number required * to work all the coaches and vans that ran in former days to and from the North. We have altogether upwards of 2700 men and 640 horses engaged in the goods business in London, in addition to about the same number employed by Messrs. Pickford as our agents." Out of this regiment of heavy cavalry half are stabled under the arches of Broad Street; and a strange sight it is to look through one of them from side to side, along an unbroken vista of backs and tails, for there are no stalls, and the animals are only separated from one another by swinging poles. Each horse has his own head-stall, with a number corresponding to that branded on his hoof, fixed up over his manger. And the horse-keepers not only say, but

* "To be kept in London"—this must, I think, be understood to mean.

appear to believe, that the horse knows it; for they stoutly assert that if, after the horse's head-stall has been slipped and he has gone off to the water-troughs at the end of the arch, the number be shifted, the horse will go in search of it and refuse to return. For my own part, I can confirm the statement to this extent—that I certainly saw a horse refuse to return to his place. But then his number had not been changed, so I fear it hardly proves the truth of the story.*

But we have lingered too long, and without stopping to describe the great rooms with scores of clerks busy all night writing invoices and way-bills, and their comfortable club-rooms adjoining, and only casting a hasty glance into the signal-box, where cipher telegrams, telling the position of every goods train on the line, and how many trucks of each sort of traffic it has got attached, are flying about thick as leaves in Vallombrosa, let us step into a goods brake and pant slowly up the steep incline on the way to Camden Town. In years gone by, Camden Town—or Camden, as the railway people always call it—was the great centre whence the goods brought by the North Western were dispersed by road to every part of London. Here, moreover, were the stationary engines that drew the trains up the steep incline from Euston, in days before engineers had realised the capacity of locomotives to go up-hill. And here, accordingly, was and still is the "running-shed," in which are "stabled" the main line engines of the London district. But, owing to the development of the suburban network of lines that centres at Willesden and carries traffic direct thence to the City and the docks on the one hand, and to Kensington and Lillie Bridge and the various depôts adjoining the southern lines at Battersea on the other, Camden has fallen from its high

* At another great railway stable not far from Broad Street, I was surprised to find a notice posted up that any carman allowing his horse to drink at a public drinking-trough would be instantly dismissed. Each van carries a bucket, and the carman is required to give his horse water at proper times. If the fear of infection that prompts this very stringent regulation has any justification, it would be as well if the authorities of the Metropolitan Drinking Fountains Association would look into the matter.

estate. It is still an immense goods depôt, but it has become, as its superintendent somewhat bitterly phrases it, a "dust-bin," to receive all the odds and ends of traffic that seem to have no special billet elsewhere.

Camden has, however, one special function, that of dealing with "station to station" traffic, goods that is which the Company has only carried or has only got to carry along the rails, and which the consigners and consignees are prepared to deliver and to fetch for themselves. "S to S" traffic, as this class is known, pays 7*s.* a ton less than the "C & D" (cartage and delivery) rate, but the difference (large as it sounds) does no more than represent the actual additional expense to the Company. "S to S" traffic at ordinary rates stops short at Camden, "C & D" goods go on to the depôt nearest their final destination. But there is nothing in outward appearance to distinguish the two classes, so we will not stop over the goods sheds, but go out straight into the yard and watch the marshalling of the trains before they finally start on their journey north.

How in the darkness, broken only at intervals by the lights of an express that dashes past with a roar on the further side, this same marshalling ever gets accomplished at all, it is beyond the capacity of an outsider even to conceive. A passenger train, say the Irish mail or the Liverpool express, is a simple matter. So many coaches, varying, perhaps, according to the season or the day of the week, from eight to fourteen, are formed into a train, and then they start, whether there are passengers to fill them or not. But, on the 11.20 "goods," Broad Street may send one day thirty trucks, and the next a dozen, and Camden must make up to a full load, with trucks from Poplar, Nine Elms, and Stewart's Lane, or, if need be, in the last resort with empty wagons. And yet, for all this, but ten minutes or a quarter of an hour is probably allowed. It is only by a very free use, not only of the telegraph, but of the telephone, to all the other goods stations that the work can be got through in the time allotted. To show with what fitful rushes the traffic comes,

it may be mentioned that in May and June four specials a night of Channel Island potatoes are often sent off by the North Western Railway alone. Counting both up and down traffic, Crewe not infrequently sees twenty specials pass through in one night. There will be a good deal to say of shunting and marshalling goods trains later on, so let us just notice here that at Camden the arrangements are of an old-fashioned nature. The sidings are in parallel lines, and the trucks are transferred from one to another through two lines of turn-tables, running right across them at right angles, and worked by hydraulic power. One thing more must not be left unnoticed—a long net by the side of the passenger line, into which the guards of the up night mails throw bundles of invoices of goods that are following at a somewhat less rapid rate.

Broad Street may be hard pressed at Easter time, but it has nothing to face to compare with the vast influx of traffic that well-nigh submerges the station at Euston in Christmas week, when more parcels are handled in a day than would be dealt with in four at other seasons. Fortunately for the Company, the passenger traffic at that time is light compared with that of the summer Bank Holidays, and chiefly of what has been termed a "carpet-bag" nature, very different from the August seaside traffic; otherwise the machine could never be kept going at all. Even as it is, last Christmas the North Western, which prides itself on its ample reserves of stock, was using fruit vans, newspaper vans, half-painted luggage vans, and in some cases third-class carriages for the conveyance of its parcels. As for the Post Office, it was fairly overpowered, and two days before Christmas it shocked Euston out of all propriety by starting the postal trains, which had been standing ready to be loaded since three in the afternoon, ten minutes after their proper time. "Trains," we say, for a single train was insufficient to carry both letters and parcels, and for several days in succession each class of traffic had a whole train to itself. So hard were the authorities run for post-office vehicles, that a sorting-van

usually kept in reserve at Aberdeen in case of breakdown in the North was telegraphed for in hot haste to be sent to London. If the North Western officials should boast that their own parcel arrangements were working meanwhile with the regularity of clockwork—as indeed they were—on the other hand, it is fair to remember that they have had forty years' experience to guide them, while the whole Parcel Post organisation has had to be built up in a tenth part of the time.

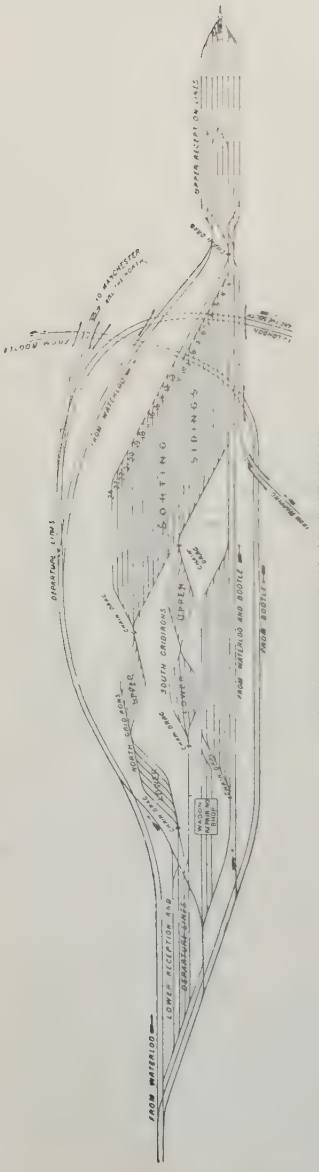
That no time might be wasted, or confusion risked by unnecessary transfers, the Company's traffic was subdivided as minutely as possible. For instance, a van ran through *viâ* Willesden from Victoria to Liverpool, a second from Broad Street to Manchester, and a third from Waterloo to Perth. At ordinary times probably a hamper apiece would have been more than sufficient. Similarly the twenty or thirty districts into which London itself is ordinarily divided were cut up into smaller sub-districts, each with its corresponding sorting station. I saw a good-sized room entirely filled with printed labels to be affixed to the different trucks and vans and luggage cupboards, to secure that nothing should get mixed in transit.

If subdivision is the one secret of organisation, the other is "little and often." Had the parcels been left to accumulate for many hours in succession, the station and staff would assuredly all have been buried beneath them. But, what with ordinary and special trains, they were streaming away as fast as they could come in, a parcel "special" being actually interposed between the midnight express and the newspaper train at 5.15 next morning. Lest the receiving offices should get blocked with traffic, some of them in the busiest parts, such as the City, were cleared as many as twenty times in the day. Each collecting van has a time-table drawn up for it, in which its work for the whole day is marked out to the minute, exactly like an ordinary passenger train in "Bradshaw," and, as far as I saw last Christmas, the vans worked to their time-tables with a punctuality that

ordinary trains by no means display. It is remarkable what a little a single van can do. The officials count that it is not economical to give a carman more than about fifty packages to deliver at one time. With more than this number, he not only wastes time in turning the contents of his van over and over to find each particular parcel, but there is also more risk of the goods being damaged.

The "baggage-smasher" is a recognised and appreciated institution on American railways, but, to judge by its methods of packing and securing fragile articles, the British public appears to credit its railway servants with the possession of a touch as light as a pianist's. Among all the strange consignments the strangest that I saw was a crate containing two cygnets almost full-grown, which sat composedly stretching their long necks through the bars and fixedly regarding the wilderness of dead turkeys in the midst of which it was their fate to find themselves. The parcels traffic is comparatively easy to deal with when Christmas Day comes right at the end of the week. When it falls on a Wednesday, the parcels all come on the Monday and Tuesday, and then the crush is far worse. Still one cannot but wish that Christmas Day would always fall on a Saturday or a Monday instead of a Sunday, that so the men might have an extra day's rest after their tremendous exertions.

In some ways the goods traffic arrangements of Liverpool are even more remarkable than those of London. At Liverpool the North Western has six goods stations, two of them reached by tunnels each a mile and a quarter in length, constructed for their use alone. The Lancashire and Yorkshire has another half-dozen, while the three railways that own the Cheshire lines—the Midland, the Great Northern, and the Sheffield—have as many more. Of one of the North Western dock depôts, that of Waterloo, we must just say one word. The goods are loaded straight away into trucks as fast as they arrive, the only distinction observed being that full truck loads are dealt with on one side of the station, and



EDGEHILL: PLAN OF THE YARD.

broken loads on the other. As soon as a train load of trucks is ready, it is pushed a few yards out of the station by a shunting engine till it reaches the mouth of the tunnel. From this point it falls by gravity half a mile to an opening, about a hundred yards in length, at Byrom Street, where it is brought to a stand. Hence to Edgehill, where all the trains leaving Liverpool meet and are marshalled ere they begin their journey, is a steep ascent of one in sixty-five for over a mile. The trains are drawn up, not by locomotives, but by an endless rope worked from the summit. I was seated on one occasion on the open brake truck to which the rope is attached. The sheaves had been tightly screwed down, the signal was given and off we started. We had gone perhaps fifty yards, when with a tremendous noise the rope slipped, and began to race through the blocks, and at the same moment the train stopped, and then began to run slowly backwards. In a few seconds the engines were stopped, the rope ceased

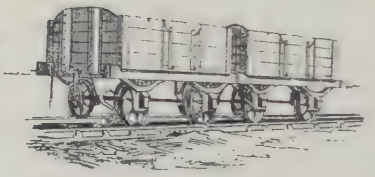
running, and the train was brought by the brake to a standstill, and then for the first time I realised what had happened. The sheaves were readjusted, and we started afresh and reached the top in safety; but I carried away one distinct impression, that, if at any time it should be my fate to be in a railway accident, I trusted it would not take place in a tunnel. The darkness and the noise must add enormously to the sense of helplessness, which in any case is not a pleasant mood in which to confront danger.

Edgehill is called a goods "yard." It contains, however, fifty-seven and a half miles of line, and has cost somewhere about two millions sterling. After gradual progress towards perfection for fourteen years, it has now in the last few months reached the point that the whole of the goods traffic arrives and departs absolutely independent of the ordinary passenger lines into Lime Street Station. To gain this end, tunnels, and arches, and skew bridges are conspicuous on all sides. But this is a feature common to many other modern goods yards. The special characteristic of Edgehill is that the sorting and marshalling of the trucks are done entirely by gravitation. Let us trace the further course of the train that has just come up from Waterloo. It consists of thirty-eight trucks thrown together haphazard, destined probably to go by a dozen different trains to two dozen different stations.

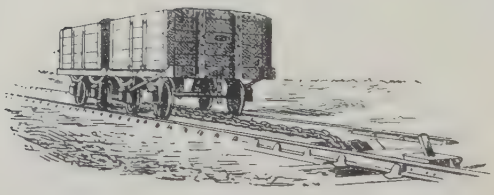
At the mouth of the tunnel the rope ceases, the brake-van is uncoupled, and an engine takes its place. We mount on to the foot-plate, and then the engine puffs laboriously up for a mile and a half to the top of the bank. It is immediately detached and (as John Bunyan would have said) goes on its way, and we see it no more. The train is left standing on one of seven parallel "reception" lines. We walk down the hill for some 300 yards to a point where all the reception lines converge into a neck, and then immediately divide into two "through" lines Each "through" line spreads out again below by a series of "points," turning

off it much at the same angle as the strings are carried off the frame of a harp, into a fresh set of twelve "standing" lines, thus making twenty-four in all. At the neck is situated a signal-box, and at the entrance of each standing line is a

STOP.



STOPPING.



STOPPED.

EDGEHILL: ARRESTING A RUNAWAY.

post with a number painted conspicuously on it. Each number denotes a train for some special destination. Along the "through" lines, at convenient intervals, shunters are distributed awaiting the trucks.

As we walked down along the train, a foreman shunter followed us, and, reading the destination of each truck on its label, chalked upon it a figure corresponding to the number of its proper standing line. And now all is ready, the signal is dropped, the first truck, numbered let us say 13, is uncoupled with a shunting stick, and its side brake taken off. It starts at once by its own weight, runs forward to the neck, the signalman reads its number as it passes, and pulls over the points admitting it on to the proper "through" line. As it passes down the row of shunters, if it seems to be running too fast, someone will check its speed by a momentary application of the brake; then, as it arrives opposite No. 13 road, the shunter nearest it turns the truck in, and, the brake being again fastened down, it is brought to rest.

Long, however, before it has reached its position, two trucks for No. 5 have been let go, closely pursued by one more for No. 19, and then three together for No. 2. Quick as lightning, as they roll past him, the signalman reads the numbers and opens the right points, while at the entrance of each line the men are all ready to catch and arrest the vehicles as soon as they have gone far enough. In six minutes from the time the train was taken in hand, the first stage is accomplished and the trucks have been scattered to form portions of perhaps fifteen different trains. In front of the signal-box at the neck between the rails is a hole, and fixed in the hole at the level of the rails is a big hook. The hook is interlocked with the signal, and when the signal stands at danger it is lifted up and protrudes from its hole, so as to catch the axle of any truck that ventures to pass the signal. But a sudden jerk would break the hook or the axle; so the hook, instead of being fixed, is attached to a heavy cable. A runaway truck, therefore, "drags at each remove a lengthening chain," till finally it is brought harmlessly to a standstill. But, ingenious as the invention is, it is not often that the carelessness of a shunter affords an opportunity of proving its efficiency. Since 1876, however, the chain drags have been brought into use 135 times, and

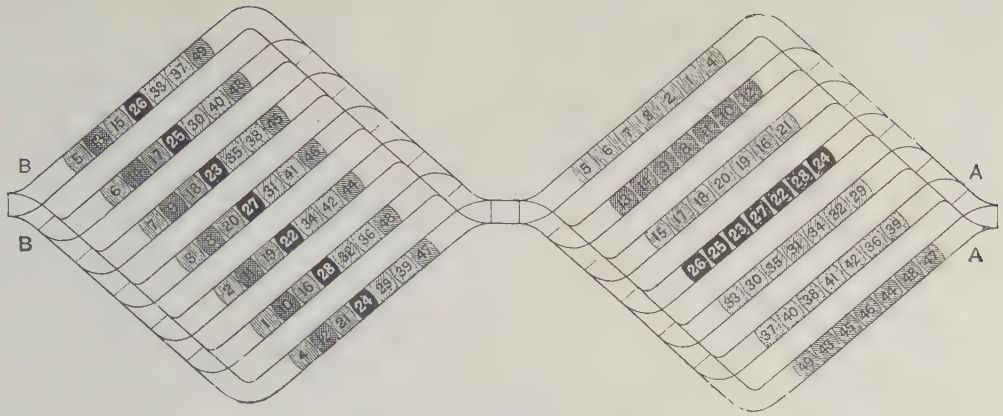
they have never once failed to arrest the runaway, and that without injury either to truck or load. "Without this safeguard," writes Mr. Footner, to whose inventive genius the conception and execution of the whole of these immense works is due, "the danger and destruction which would result from runaways upon the steep gradients at Edgehill would be sufficient to oblige the Company to abandon the sidings altogether." *

So far, however, the work of the sorting sidings is only half done. Let us suppose that twenty trains have gone through the process we have described—and fifty or sixty trains have in fact to go through it every evening—the standing lines are filled, but the trains are by no means ready to start. Let us take No. 1, and say we find on it forty trucks for stations from Rugby to Willesden inclusive. Four are for Northampton, ten for Bletchley and its branches, five for Leighton, seven for Watford, and the rest for Willesden. But they are scattered at haphazard up and down the train. In railway language, the trucks have been "sorted" but not "marshalled." If the train is to start like this, it will have to spend an hour at each place, shunting backwards and forwards to pick out here and there a truck. Before its work is finished, the engine will have travelled a dozen miles to no purpose, to say nothing of the damage to the trucks and their contents by incessant jolting. Let us come down to the bottom of the standing lines and see how this difficulty too is faced. The standing lines also end in a neck, and then the neck again expands, but this time in a different fashion entirely.

The new figure, or perhaps it ought to be figures, for they run in pairs, are shaped, some like balloons whose seams are lines, seven in number in each balloon, and each seam only long enough to contain seven trucks; others look more like gridirons. Imagine our train admitted on to one of the

* [At Dresden, where an immense gravitation sorting yard has recently been established, there are substituted for Mr. Footner's chained hooks deep layers of sand at the lower end of the sidings, and this system is said to be successful in practice. 1899.]

Train before entering the gridirons at A A.



Train being passed through the gridirons.

Train after passing off the gridirons at B B.

METHOD OF WORKING THE GRIDIRONS.

balloons—or, as they prefer to call them at Edgehill, "gridirons." "Northampton trucks, line A," says the foreman shunter; "B and C lines for Bletchley; D for Leighton," and so forth, till all the trucks for the same station have got together. If there are trucks for more than seven stations on the same train, the second balloon lower down subjects them to a yet further process of marshalling. One thing more is necessary—that the trucks for the most distant station shall be at the back of the train, and those to be dropped first shall be in front. To secure this, it is only needful to let out first the trucks that are going furthest; they will naturally run to the back of the train as it gradually forms itself below the gridirons on one of the series of "departure" lines at the bottom of the gradient. The operation is now complete. When the time comes for the train to start, the engine has only to hook on in front and steam straight away to its destination.

There are many sets of gravitation sidings in England, one of the newest and largest just opened by the Lancashire and Yorkshire a few miles off, at Aintree. But most of these only attempt to *sort* trains, leaving the *marshalling* to be done by shunting engines in the ordinary manner. In marshalling by gravitation the first experiment was tried at Edgehill, and, now that that experiment is a pronounced success, it is only right that the credit of it should be given to Mr. Footner, one of the chief North Western engineers, who not only devised the scheme, but carried it out with his own men without the intervention of a contractor, and subsequently organised the shunting staff and superintended their working till the whole thing had passed beyond the experimental stage. On one point Mr. Footner must reflect with singular satisfaction. Shunting is, and, so long as the proverb, "Familiarity breeds contempt," remains true of human nature, always must be, more or less dangerous work. In the old days at Edgehill fatal accidents were frequent. Since the new system was adopted, though over half a million wagons pass through the sidings in a twelvemonth'

only one shunter has been seriously injured. Still, admitting the advantage of the system, to the lay mind it may seem strange that a commercial undertaking should be ready to spend two millions sterling in order to facilitate the arrangement of a lot of goods wagons. So let us add that the arrangement of goods wagons on the North Western for the year 1887 implied the employment of the whole time of nearly 400 engines, which collectively performed about two million hours' work at a total cost of precisely £497,437.

Changed though it may be since the days when the 'Rocket' and the 'Sanspareil,' brilliant in jockey colours, competed on the Rainhill course with the 'Novelty' under the guidance of Fox—himself to rise twenty years later to European fame as Sir Charles, the builder of the Great Exhibition—the neighbourhood of Edgehill must always be to the railway enthusiast classic ground. Here it was that the great Thomas Brassey, with fear and trembling, took his first contract for a short stretch of line. A dozen miles off, at Parkside, let into the wall of the pumping-engine-house, and half concealed by a modern water-tank, is a tablet to the memory of Huskisson, which reminds us of the melancholy result of the first recorded railway accident. Chat Moss, that sixty years back would have swallowed a crowbar let drop by chance from a navvy's hand, has grown solid to the bottom with the train-loads of ballast that two generations of platelayers have spread over its surface; and it needs a vivid imagination to perceive the gently undulatory motions that our ancestors felt. Stone blocks have been replaced by steel sleepers, and the water-tank at which Fanny Kemble's "she-dragon" paused to drink by Ramsbottom troughs, but we still pass through the great Olive Mount cutting, looking like "a passage effected by some freak or convulsion of nature" with "a noise like the loudest thunder," and under the great skew bridge whose span filled Stephenson's contemporaries with awe.

It is only a few months back that an impious engineer marred the quiet of a Sunday morning by blowing up one of the original bridges which was unduly narrow for the

overgrown "coaches" of to-day.* But the close observer can still notice that the slopes of the cuttings on either side end a few feet short of the line in a dwarf retaining wall, though the slope of the ground is again continued forward in front of the wall. The old Liverpool and Manchester directors appear to have looked upon their "she-dragons" as "kittle cattle," and to have determined to provide themselves with something softer than masonry to run into. And, if the great Edgehill tunnel has disappeared along with its "beautiful engines and the admirable contrivances for working the band or rope to which the trains are attached," at least it lives elsewhere; for the stone that was taken away when the tunnel was converted into an open cutting has gone to build the lodges in the Jubilee Park at Crewe, while in the Crewe foundry the sand is helping to cast the fittings of a new generation of North Western engines.

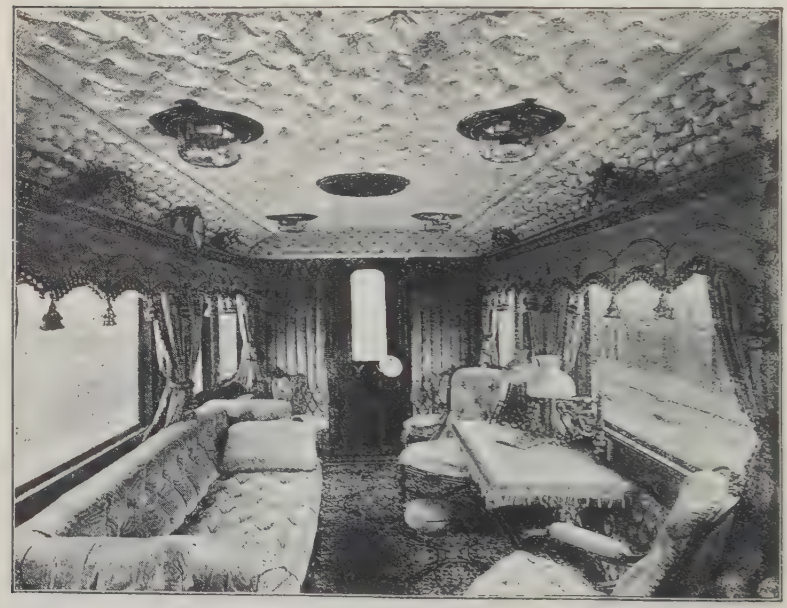
As, some pages back, we dashed in imagination through Wolverton, travelling fifty miles an hour on the engine of the express, we saw nothing but the ghost of the former glories of its refreshment-rooms. But Wolverton, whose great carriage works employ about 3500 hands, deserves notice, not only for what it has been, but for what it is. Compared, indeed, to Crewe, which seems to make everything, the work of Wolverton may be considered circumscribed. It makes nothing but what railway officials call "coaching" stock—carriages, that is, horse boxes, carriage trucks open and closed, luggage, fruit, and fish vans, and other vehicles which run on passenger trains. Goods trucks

* Many of the old bridges were only wide enough to leave a space of 4 feet—instead of the standard width of 6 feet—between the rails. The bridge referred to in the text was the last of its kind. According to a contemporary account, it was this contraction of the "six-foot" that was responsible for the death of Mr. Huskisson. The Maryport and Carlisle was originally constructed and remains to this day with a distance of 4 feet 8½ inches between the two pairs of lines. The advantage of this method was supposed to be that a truck could at any time be run down the middle.

are built at Earlestown, half-way between Liverpool and Manchester, where another couple of thousand workmen are employed. "Coaching" stock appears, however, to include numerous appendages, such as omnibuses, parcel carts, hand barrows, and so forth, which belong to the working of the passenger department, as all these are made at Wolverton. On the occasion of my visit, there was in one of the sheds a brand-new hansom cab. In astonishment I asked whether the Company, having already with its comfortable omnibuses dealt a crushing blow at the "growler" interest, was now going on to compete also with the hansom proprietors. But the manager reassured me; it was only a cab that had been sent down to be painted in proper North Western colours, as a pattern for imitation by the rest of those licensed to ply inside the station yard at Euston.

Let us cast a hasty glance round some of the finished stock. And though the Queen's train has been described often enough—not infrequently by authors who can never have seen beyond the outside of the carriages—we must, as in duty bound, yield Her Majesty the first place. "The Queen's Train," it may be remarked, is a misnomer to start with. There is no such train. Two saloons there are, close-coupled and connected by a gangway, that are reserved for Her Majesty's exclusive and personal use, which never leave Wolverton except to carry her to or from Balmoral; but that is all. The rest of the royal train is made up with such saloons or other vehicles of the Company's ordinary rolling stock as may on any particular occasion be required. Nor are the Royal saloons themselves in any way very remarkable. One thing to be noticed is that they are entered by a folding carriage-step, a survival, doubtless, from the days when platforms were not yet of a uniform and sufficient height. The floors are deeply carpeted, and the sides and roof thickly padded with quilted silk, to deaden the noise and vibration of the train, from which, as is well known, Her Majesty suffers. To reduce this to a minimum, she—by her own desire—travels to and from Scotland at a speed

markedly below that which the meanest of her subjects can command any evening in the week for the modest payment of a good deal less than one penny per mile. One of the saloons is fitted as a bedroom, the other as a sitting-room, and between the two is a lavatory, whose basin and fittings in metal, chased and gilt, deserve to be mentioned as a real work of art. These saloons are, it should be added, now



THE QUEEN'S DAY SALOON.

more than twenty years old. Since they were built the art of railway carriage construction has advanced with rapid strides, and the North Western authorities would willingly, if permitted, replace them with new ones.*

Her Majesty is content with two saloons. The late

* [This has not been permitted, but recently the twin-saloons have been taken off their old six-wheel frames and joined together into one long carriage mounted on two six-wheel bogies. 1899.]

Emperor William, on his travels, was accustomed to use three connected together: the first, a day saloon hung with blue damask, with a *coupé* at one end, in which he usually stood or sat in a high chair when passing either through a large town or else through fine scenery; the second carriage contained a study and a dressing-room, while the third was the Emperor's bedroom, and contained the camp bed which he always used. The military simplicity of King William's accommodation would have looked but Spartan by the side of the train of the late Emperor of the French, which consisted of nine carriages "communicating with each other by tastefully decorated bridges." To say nothing of dressing-rooms, bedroom, dining-room, kitchen, and wine cellar, there was a "handsome sitting-room furnished with chairs, ottomans, pictures, clocks, and chandeliers"; a study containing an "elegant writing-table, a clock in the style of the Renaissance, a thermometer, a barometer, and a telegraph apparatus"; and, last but not least, "a conservatory for the choicest flowers." In 1875 this train was purchased by the Czar, refitted, redecorated, and enlarged, till it now consists of no less than fifteen saloons, running on ninety wheels, whose gauge can be adjusted to suit either the ordinary European or the special Russian width of line. In this train, which, in addition to eight sleeping carriages, comprises also, *inter alia*, a boudoir for the Czarina and a nursery for her children, the Russian royal family returned last year from their visit to Copenhagen.

The Queen is not the only person who keeps private saloons at Wolverton. Close by may be seen a carriage with the Prince of Wales's feathers blazoned on the panels, and beside it a second with the much more imposing-looking ducal arms of Sutherland, whose bearer, not as Duke of Sutherland but as owner of Trentham, is an hereditary director of the North Western.* The Duke's saloon, having on its frequent journeys to and from Dunrobin to reckon

* On the Great Western a similar privilege is attached by Act of Parliament to the owner of Wynnstay.

with the abrupt gradients of the Highland line, is fitted with a powerful hand-brake. But no one can look at these carriages, and then go on to examine one of the ordinary West Coast Joint Stock sleeping saloons, without feeling that a railway is indeed a great leveller. Confined within the narrow limits of the "four-foot" way, dukes and princes have to fare much like the rest of us. Marlborough House and Sandringham, Trentham and Dunrobin—these no doubt are unattainable by the mass of mankind: but for the moderate sum of "five shillings, in addition to the ordinary first-class fare," we can spend the night in as comfortable a bed as any prince or duke in England.

The extent to which sleeping carriages have increased in the last few years is certainly remarkable, and at Wolverton may be seen whole stacks of mattresses, and whole piles of the neat little brass bedsteads that belong to the furnishing of the night saloons. That passengers gain by the innovation is undeniable. Whether it is equally profitable to the companies, seeing that, even if every bed is filled, for every passenger the carriage holds, something over a ton of dead weight has to be hauled, is another question. As a matter of fact, the upper berths are so very rarely occupied, that we may fairly say that the company never carries more than one passenger for every two tons; taking all the year round, probably four tons is not far from the average. Even then we are taking no account of all the costly fittings and the extra attendance that need to be provided in the sleeping carriages.*

Railway passengers, as a rule, hardly recognise how much more the companies give them for their money than was the case a generation back. In speed, and frequency, and regularity of service the advance is probably visible to most eyes; but the improvement of the carriage accommodation, which has fully kept pace with the improvement of the train service, is usually ignored and not infrequently denied.

* [Upper berths have now practically disappeared, and the most recent type of "sleeper" allows each passenger a compartment to himself. 1899.]

Here is what the *Observer* writes in a leading article dated September 2nd, 1888: "Nothing has been done to make the first-class or second-class carriage better or cheaper than it was thirty years ago." Let us see how far this statement is founded on fact. The old original "first-class" was 15 feet in length and $6\frac{1}{2}$ feet in breadth by only $4\frac{3}{4}$ feet in height; and within these limits it was supposed to seat eighteen passengers. Now look at what the North Western authorities term their "standard 42 feet tri-composite." This carriage, which is at present the accepted pattern for main line trains, runs on eight wheels and contains five passenger compartments: in the centre a luggage cupboard; on the one side two first-class compartments with lavatories between; on the other, one second and two third-class compartments. Accordingly ten first-class passengers have as much room as twenty-eight second and third-class. To compare with the carriage of a generation back, each first-class passenger then had about twenty-six feet of cubic space, to-day he has ninety. As for fares, a first-class passenger to Carlisle in 1858 paid 56*s.* 6*d.*—except by the 'Limited,' by which 66*s.* was charged—a second-class 40*s.*, as against 40*s.* 6*d.* first, and 32*s.* second,* to-day. To Liverpool the fares were, first-class, 45*s.* express, 37*s.* 5*d.* ordinary; second-class, 27*s.* To-day the fares are 29*s.* first, and 21*s.* 9*d.*† second-class by all trains. The writer quoted above has perhaps one justification for his discontent, if it be a justification, that, vast as the improvement has been in the first-class accommodation, the gap that separates first-class from third-class has been steadily narrowing.

A carriage such as that described above weighs 16 tons and costs £800 to build. A carriage of similar size, divided simply into seven third-class compartments, only costs £600. Assuming it to be quite filled, it would earn 5*s.* 10*d.* per mile. The more expensive carriage, even if every seat were occupied (a still less likely supposition, as first and second-

* [26*s.* 8*d.* 1899.] † [20*s.* 8*d.* 1899.]

class carriages are never half so well filled as third, could not earn more than about four shillings. No wonder the enlightened management of the great northern companies does all it can to encourage third-class traffic. Out of the £600, nearly half is spent below the floor of the carriage on the under-frame. The framework is nowadays of steel, and is sent to Wolverton from Crewe ready-made. Each of the four pairs of wheels with its axle costs £12 and weighs a ton. The two pairs beneath the middle of the carriage are fixed to the frame, those at either end have a radial motion that allows for play in rounding curves.* Between the axles, what with the india-rubber draw-bar springs and buffer springs, the gas reservoirs and the brake reservoirs and cylinders, there is little room left where a stowaway could attach himself, as used sometimes to happen in former days. All the West Coast coaches have two sets of brakes, vacuum for use in England, Westinghouse automatic north of Carlisle: each brake with its own reservoir, its own mechanism, and its own set of pipes. If the vehicle is a guard's van, there is a third set of levers to be worked by the hand-brake.

In amusing contrast to the spick-and-span main line stock with its sixteen coats of paint worked up and varnished till one can almost see one's face in the panels, I came upon some old third-class carriages with a most poverty-stricken appearance, destitute of even a vestige of cushion or hat-rack, and hazarded the guess that these must be part of the rolling stock of some bankrupt Welsh company that the North Western had taken over. The true explanation was, however, that they belonged to a mineral branch, and were used exclusively by colliers going to and from their work, for whose use cushions would certainly have been out of place. One of the most recent specimens of Wolverton work is what might be termed "dog saloons," for so their arrangement as compared with the dog hutches of former years really

* [Nowadays the North Western builds bogie rolling stock like its neighbours, and the standard length of coach has increased to 50 feet and upwards, while the weight runs up sometimes to over 30 tons. 1899.]

entitles them to be called. They are intended for use either at the time of the August "grouse" traffic, or on the occasion of a big dog-show. An old third-class has been taken, its partitions removed, and all the doors except the middle one closed up. Then along one side is ranged a set of roomy kennels with a wide shelf above them, on which can be set down the baskets and boxes in which dogs of a smaller size are consigned. But we must tear ourselves from Wolverton, though the half of what is there to be seen has not yet been described. One might spend hours watching the blocks of wood to form the wheels being fitted together with as much nicety as the pieces in a Chinese puzzle. But to sketch even the main outlines of the process would be long, and the North Western is not the only line in England.

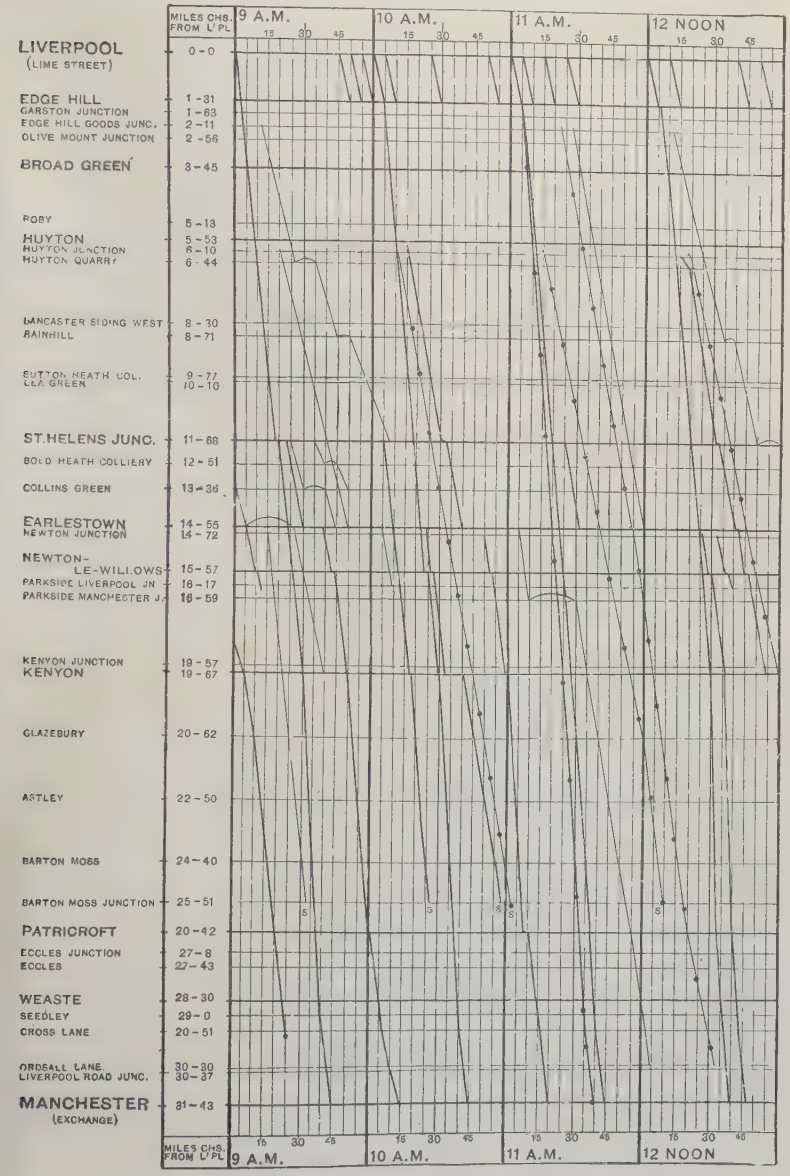
Before, however, we leave it, one more point must be noticed, what the writer of a recent letter in the *Times* calls its scientific study of connections. Though an earthquake should swallow up the refreshment-rooms at Swindon, and though Bristol should become a desert, one is constrained to believe that the 11.45 and the 5 o'clock expresses would still continue to leave Paddington at the usual hour.* But the North Western time-tables are in a perpetual state of flux, and trains are shifted hither and thither by an intelligence that is prompt to study the varied requirements of the traffic, or the altered arrangements of neighbouring companies. The writer from whom I have quoted above mentions the fact that a South Western train from Salisbury and the West is timed to reach Fratton two minutes after the last Brighton train has left for the East, and the diligent student of "Bradshaw" will have no difficulty in supplying for himself similar instances of unscientific arrangements from the time-tables of other companies; but, if he expects a quick return

* [It is ill prophesying unless you know. Swindon refreshment-rooms are disestablished, the 'Cornishman' runs through Bristol without stopping, half the 11.45 now goes at 11.30, and the 5 o'clock express,- after numerous intermediate changes, now leaves Paddington at 6 P.M. 1899.]

for his labour and research, he will be wise not to begin his investigations on the North Western system.

And yet it is not an easy line on which to introduce alterations in the train service. Parts of it, as, for instance, the section from Leeds to Manchester, are perhaps as crowded as any railway in the world. The "diagrams," as they are called, which are prepared in the time-table office to show the train-working, deserve a word of notice. Let us take the one, or rather the pair, for there is one for the up and another for the down traffic, between Leeds and Manchester. Imagine a board 4 feet in length and 2 feet wide. Its length is divided into 24 sections corresponding to the 24 hours from midnight to midnight. Down the width of the board are written the names of the stations, at intervals proportionate to their actual distances apart. Then a coloured string for each train, yellow for passengers and blue for goods, stretches across the board and shows its progress. An "express goods," let us say, starts from Leeds at 5.15 A.M. Its blue thread is pinned on the board at the top, one-fourth of the way between the 5 o'clock and the 6 o'clock line. At Batley, 8 miles off, where the train waits from 5.33 to 5.38, the thread, which has sloped down obliquely from Leeds, moves forward horizontally one-twelfth of an hour's distance, and then obliquely again to Heaton Lodge, which is reached at 5.56. Before the train leaves again at 6.3 perhaps a fish train may run through without stopping. If so, its thread will be carried obliquely across between the two pins that mark the arrival and departure of the goods train. A stage further, and it may be a yellow passenger thread that crosses, till finally at 7.40 the string that began at 5.15 ends short at Staleybridge, as the train passes on to the Sheffield line. At certain hours of the day the pins fairly jostle each other near the important junctions, and needless to say, while at 9 A.M. their threads are almost all yellow, at 9 P.M. the blue have completely gained the mastery. With a "diagram" like this before him, the district superintendent can see at a glance what amount of consequent rearrangement is implied by the

NOTE. *Trains shown fine lines thus* —•— *run one or two days per week only. Passenger Trains thus* ——
Trains marked S come off or go on to slow lines. *Goods* ,, ,,


MILES CHS. FROM L'PL
9 A.M.
10 A.M.
11 A.M.
12 NOON
15 30 45
LIVERPOOL (LIME STREET) 0 - 0
EDGE HILL 1 - 31
GARSTON JUNCTION 1 - 63
EDGE HILL GOODS JUNC. 2 - 11
OLIVE MOUNT JUNCTION 2 - 56
BROAD GREEN 3 - 45
ROBY 5 - 13
HUYTON 5 - 53
HUYTON JUNCTION 6 - 10
HUYTON QUARRY 6 - 44
LANCASTER SIDING WEST 8 - 30
RAINHILL 8 - 71
SUTTON HEATH COL. 9 - 77
LEA GREEN 10 - 10
ST. HELENS JUNC. 11 - 68
BOLD HEATH COLLIERY 12 - 51
COLLINS GREEN 13 - 36
EARLESTOWN 14 - 55
NEWTON JUNCTION 14 - 72
NEWTON-LE-WILLOWS 15 - 57
PARKSIDE LIVERPOOL JN 16 - 17
PARKSIDE MANCHESTER J. 16 - 59
KENYON JUNCTION 19 - 57
KENYON 19 - 67
GLAZEBURY 20 - 62
ASTLEY 22 - 50
BARTON MOSS 24 - 40
BARTON MOSS JUNCTION 25 - 51
PATRICROFT 20 - 42
ECCLES JUNCTION 27 - 8
ECCLES 27 - 43
WEASTE 28 - 30
SEEDLEY 29 - 0
CROSS LANE 20 - 51
ORDSALL LANE. 30 - 30
LIVERPOOL ROAD JUNC. 30 - 37
MANCHESTER (EXCHANGE) 31 - 43
S

EXTRACT FROM "DIAGRAM" OF TRAINS WORKING FROM LIVERPOOL TO MANCHESTER (*vid* NEWTON-LE-WILLOWS).

alteration or acceleration of any individual existing train. And he can also see, what he, however, scarcely needs to be told, that the introduction of an entirely new train is well-nigh an impossibility.

To Londoners at least the most important North Western connections are those which are made at Willesden. From Willesden there are frequent trains to almost every terminus in London, and by arranging beforehand it is possible for a reasonable-sized party to travel without change of carriage to almost every point in the south of England. At Willesden, moreover, every main line express stops, both up and down, with four exceptions, for each of which there is a good reason. The two down Irish mails are under the orders of the Postmaster-General, and the 5.15 A.M. down, and the 'Limited' due up into Euston at 3.50 A.M., pass through at a time when no local connections are available. I cannot but think that the North Western are wise in this policy of "thorough."* Most of the great lines have a station corresponding to Willesden. The South Western and the Brighton have Clapham Junction; the Great Western, Westbourne Park; the Midland, Kentish Town; the Great Northern, Finsbury Park. But none of these approach Willesden in usefulness, from the fact that at none of them do all the trains stop. Unless they do, it is not worth the companies' while to organise a complete service of local connections; and then, turning the question the other way round, till such a service is organised, the public will not learn to forego the accustomed hansom to or from the terminus. It seems to me almost an axiom (and long observation of services such as, *e.g.*, the Great Western into Victoria, or the Chatham and Dover to Clapham Junction, has convinced me of its truth), that, unless in the case of special night and morning business trains, a local and connecting service must be both regular and frequent if it is to be successful.

* [The theory is excellent, but unfortunately the facts have failed to fit into it. See Supplementary Chapter. 1899.]

It would not be right, however, to place the whole of the Willesden connections to the credit of the North Western. The North London deserves at least a fair slice of the praise. But the North London, though organised as an entirely independent line, with a separate directorate and separate staff, is really little more than the *alter ego* of the North Western. Two-thirds of its ordinary capital is held by the North Western as a company, and, if common report says true, the remainder by North Western shareholders in their individual capacities. The chief officer of the line has, as General Manager, an office at Broad Street, but in his capacity as Secretary his office is at Euston. The object with which the North London was constructed is obvious from its original title, "The East and West India Docks and Birmingham Junction Railway"; and though to-day the passenger traffic has become so large that two-thirds of the revenue of the Company is derived from this source, and that at certain hours all goods service over the line is peremptorily forbidden, there is still an immense goods traffic, not only to Broad Street, of which enough has already been said, but also to the river-side at Poplar.

Here, wedged in between the East and West India Docks, the North London has two very complete docks of its own, which it, so to speak, lets out in lodgings to its various tenants. The North Western has built its own house on its own land, and so has only to pay for the use of the entrance-hall, but the Great Northern and the Great Western have taken apartments ready furnished with hydraulic power and all other necessary accommodation. On a visit there recently I was told that the development of telegraph cables and regular mail services has wrought a complete revolution in the dock trade in the last few years. Merchants even as far away as Melbourne have ceased to keep large stocks on hand. A ship's cargo is growing every year more miscellaneous. A man who a generation back would have ordered, say 50 tons of a particular gauge of iron wire in one consignment will

telegraph for it nowadays to the works, 5 tons at a time, just as he may happen to want it. "But how," I asked of a North London official, "do you maintain harmony among three different tenants? How, if the North Western gets a particular piece of traffic that the Great Northern would have liked to have, do you escape, at least, the suspicion of favouritism?" "Ah! there," was the reply, "is just the strength of our position, we have no need to interfere in the matter. We are not obliged to canvass at all, the traffic must go over our line in any case; all we have to do is to hand it to the company that we are told to hand it to."

This same canvassing produces at times rather remarkable results. It would hardly occur to an ordinary passenger to go to Paddington if he wanted to book to Manchester; or to Euston if he was on his way to Bristol; and yet the North Western takes *viâ* Blisworth, Stratford, and Cheltenham, a fair share of the Bristol traffic, while the Great Western repartee with an "express goods" to Manchester. Out on the open wharf adjoining the goods sheds there is a curious sight. Side by side are two rows of coal stages; the one for loading coal from trucks into lighters, the other for transferring it from ships or lighters to trucks. The explanation is as follows. The "outwards" traffic is in rail-borne coal that is going up the canal to adjacent coal depôts, the "inwards" is north-country sea-coal—as our ancestors would have called it—on its way to the gas-works at Bow Common. Hard by are huge cellars in which Bass's and Allsopp's beers are stored for export.

Not far off, at Bow, the North London has its works. Bow might be described as a miniature Crewe—if indeed a place employing 1000 men can be described as a miniature—for it makes everything that the Company requires. And at Bow they take care to have the best of machinery and appliances to do it with, for the Company, though small, is both wealthy and enterprising. At present, experiments are being made in substituting steel for copper in various parts of the locomotive,

the boiler tubes and the fire-box stays, for instance—an experiment which, it is safe to say, will be watched with interest by other lines, if copper continues much longer at its present price.*

Reader! gentle, or shall I say, simple, did you ever, like the present writer, bless the railway companies for providing what you fondly imagined to be a draught-excluder—a strip of wood fastened along the crack of the door on the inside? If you did, go to Bow, and you will learn that your gratitude has been misdirected. What you fancied a draught-excluder is really intended to prevent passengers from getting their fingers shut in when the door is slammed. A hard-hearted official may even go so far as to suggest that, while crushing passengers' fingers is an expensive business, the company has never yet been required to pay compensation for colds caught on its premises. But the chance of having a finger crushed is a trifle compared to the certainty of a headache from door-banging, so let me express my gratitude to the carriage superintendent for his new spring-handle which, as already mentioned, can be opened and shut, easily, safely, and noiselessly, as well from the inside as the outside of the carriage. Here is an item from the carriage works, to show what the command of the best machinery means. A few years back the cost of labour for building a five-bodied second-class carriage was £48. At the present time it is £18, and, needless to say, the rate of wages has not fallen in the interval.

It has been said already that Broad Street Station, and the line thence to Dalston Junction, was an after-thought. It was undeniably a happy one; for in two most important respects, even timing and a most careful study of cross-connections—one might say in a third respect, punctuality—Broad Street sets an example of which not a few London

* An experiment so far as England is concerned, though of course it has long been the common practice in America. [England still remains wedded to copper, while in the States steel is equally a matter of course. 1899.]

suburban services only too sadly stand in need. Let us take a concrete instance, and for choice let us take it from the district least likely to be familiar to the ordinary reader, the East end. We will start, let us say, on the 10.35 A.M. from Broad Street—there is no need to carry pocket time tables on the North London, and 5, 20, 35, or 50 minutes after any other hour would do equally well—on a Blackwall train. Dalston Junction is reached at 10.45, and there we find awaiting us the passengers from all the stations on the line westward who arrived 10.44. Three minutes later we are at Hackney, where through a covered way there is communication with the whole of the Cambridge line portion of the Great Eastern system. Another six minutes takes us past Homerton to Victoria Park. At this point, by means of a small "shuttle" train, running backwards and forwards from here to Stratford, a similar connection is made with the Colchester half of the Great Eastern.

Four minutes more, and we are at Bow, to find that yet another Great Eastern train has just brought us passengers from Fenchurch Street, and that a corresponding train will set off with a return load as soon as our train has drawn clear of the station. At Bow, many of the trains have a second connection, to Bromley on the Tilbury and Southend line. Forty-six passenger trains *per diem* are here interchanged between the two companies, but it is not found possible in this instance to introduce the great North London principle of even timing. Seven minutes more, and our train has reached its destination. It may be thought that its course as sketched above is as liable to interruptions as that of the old woman who set out, in the nursery tale, to buy a pig; but, in fact, in spite of all its incidents the old woman's journey was successful, and if anyone likes to try the experiment he may trust to making all the connections over again on the up journey, and being back at Broad Street at 11.41 A.M. to the minute. The North London shareholders get 7½ per cent. for their money. One can only hope that their

servants also receive of the bounties of fortune on the same scale. Certainly to neither class ought the public to grudge the fullest measure of prosperity.

The North Western Railway has been singularly fortunate in one respect. With the exception of a few years, after 1855, during which General Anson, Lord Chandos (the late Duke of Buckingham), and Admiral Moorsom each occupied the chair for a short period, it has had but two chairmen in all the forty years of its history. The first was Mr. Glyn, afterwards Lord Wolverton, who not only presided over the birth of the North Western, but was also the founder of the Railway Clearing House.* As long ago as 1862, Mr. Moon, who had already been a director of the Company for about fifteen years, assumed the position which he still occupies. In these days, when a man is often chairman of half-a-dozen companies and director of as many more, it is a fact worth notice that Sir Richard Moon has never been a director of any other company. The North London Railway is, as has been said, for all practical purposes a branch of the North Western, and its Board is largely composed of North Western representatives. It is, moreover, commonly believed to owe no small part of its success to the organising genius of the North Western Chairman, but even on its Board Sir Richard Moon has never occupied a seat. To his own line he has devoted the work of a long and laborious life. On it, if universal report may be believed, there are few matters which, with his personal ubiquity and what Sir Arthur Helps would have called his avidity of detail, he has failed to keep at his fingers' ends. The Jubilee honours of 1887 can surely in no instance have been more deservedly

* Mr. Glyn had been Chairman of the London and Birmingham Railway since 1837, succeeding in that post Mr. Isaac Solly, who was the first Chairman, not only of that line, but also of the British and American Steam Navigation Company. When the London and North Western was formed in 1846, by an amalgamation of the London and Birmingham, the Manchester and Birmingham, the Grand Junction, and the Liverpool and Manchester, Mr. Glyn became the first Chairman of the united undertaking.

bestowed than on the man who for a quarter of a century has so ruled over the greatest corporation in the world, that its name has been a proverb for honesty and uprightness of administration, and that its management has displayed a steady devotion to improvement and progress, not untempered, perhaps, with that truly English characteristic, a rooted dislike to over-sudden and hasty innovations.

CHAPTER IV.

THE MIDLAND RAILWAY

Twenty years since, when by the Disraeli Reform Bill a third member was given to what were then the seven largest provincial towns in England, it was remarked that the Midland was the only railway company that ran to every one of the seven. To-day an eighth town, Nottingham, situated in the heart of the Midland system, has increased till it can claim to rank as the equal of Bradford and Bristol. There remain four other places in Great Britain with a population over 150,000—Glasgow, Edinburgh, Newcastle, and Hull. Glasgow and Edinburgh may almost be said to be on the Midland system; to Hull the Midland run their own trains; while, even from Newcastle, the familiar red carriages of the Midland convey passengers without a change all the way south to Cheltenham and Bristol.

The steps by which the vast concern that we see to-day was gradually built up have been described by Mr. F. S. Williams in his "History of the Midland Railway." But, as the tale takes 700 pages octavo in the telling, we must not attempt to follow him. Suffice it to say now that nearly fifty years ago there was a railway from Leeds to Derby, known as the North Midland, and that two other local companies, the Birmingham and Derby, and the Midland Counties, competed together for the privilege of carrying forward its traffic for the South—the first instance of competition in English railway history. The Birmingham and Derby fell into the main line of the London and Birmingham

at Hampton,* the Midland Counties ran through Loughborough and Leicester, and did not touch the London and Birmingham till it reached Rugby. After a furious conflict, in the course of which the Birmingham and Derby was at one time carrying through passengers for 2*s.* and 1*s.* 6*d.*, while its local fares for the same distance were 8*s.* and 6*s.*, the three companies finally amalgamated in 1844 as the Midland Railway, with "King" Hudson as the first Chairman of the united Company.

From that day to this the centre of the system has been at Derby—where now the Company has between twelve and thirteen thousand people in its employ—and this fact has profoundly affected the whole subsequent course of Midland history. The North Western, the Great Western, the Great Northern, or any other of the lines with termini in London, may fairly enough be compared to a tree. They have in their suburban lines roots striking out in all directions into the soil of the metropolis, with the vitalising sap of traffic flowing thence to and fro along the trunk, and permeating through two or three main branches into countless small ramifications in the remotest corners of the country. The tree may be huge and wide-reaching; but, however vigorous its growth, it can only develop upwards and outwards from its main trunk. In the case of the Midland, however, we must go for a simile to the animal world. It is a great heart with its life-blood pulsating through countless arteries out from the centre of the body to the furthest extremities. But the corpuscles with which heart and arteries are charged and congested are not red but black—they are lumps of coal.

* The junction at Hampton still exists, and over the 6½ miles between Whitacre Junction, on the Derby and Birmingham line, and Hampton Junction, on the Birmingham and Rugby, there runs every 24 hours one train in each direction, mixed passengers and goods. Until the summer of 1888, passengers over a still older portion of the Midland Railway, the Leicester and Swannington, could only travel between West Bridge and Desford Junction, attached ignominiously to the tail of coal trucks. Oddly enough, there are still one or two mixed trains in the early morning on the main line of the Great Northern between London and Peterborough.

"Coal!" a certain Mr. B. of the London and Birmingham is reported to have exclaimed, when it was first suggested that his railway should carry so humble a commodity: "why, they'll be asking us to carry dung next." It is on record that when coal trucks first passed over this line they were "sheeted" down that their contents might not be suspected; and at Weedon, where coal was transferred to the railway from the barges of the Grand Junction Canal, there stood for many years a high screen, erected originally to conceal the ignominious transaction from the gaze of the passing traveller.

But the Midland Company originated in the desire of the Nottinghamshire and Derbyshire coal masters to find an outlet towards the South for the products of their pits. It was coal, first in its raw state, and secondly in the wares that it has mainly helped to manufacture, that in the course of little more than a generation raised the Midland from its original position as a mere local line into its situation to-day, when its arms extend to London, Bournemouth, Bristol, and Swansea on the one side, and to King's Lynn [Yarmouth. 1899], Carlisle, and Liverpool on the other.

Probably there are not many people nowadays who are aware that, if the Midland is the latest, it also was the earliest of the through routes to Scotland. It is just twenty years since the Midland reached London, and little more than half that time since it pushed its way to Carlisle. But before the Great Northern on the one side, or the Lancaster and Carlisle on the other, was born or thought of, Scotch passengers went to Rugby by the London and Birmingham, thence by the Midland to Normanton, and on to the Border by York and Newcastle. Later on, when the East Coast route on the one side, and the West Coast on the other, were formed into a compact through system, the Midland seemed likely to be surrounded and choked by the rapid and luxuriant growth of its rivals. The directors therefore felt that they must endeavour to become independent, and the history of the Company for twenty years is little more than

the history of this struggle. Nothing, however, is more instructive than to watch its course.

As we have said, the original Midland route to London was by Rugby to Euston; but the North Western traffic grew, and the Midland traffic grew, till the line was not big enough to hold them both. Naturally North Western traffic, even if not first come, was first served, and on one occasion, it is said, there were five miles of Midland coal trains blocked back at Rugby. And so, early in the fifties, the Midland set to work to get a second string to their bow. They built a line from Leicester to Bedford, and on to join the Great Northern at Hitchin, and thus found their way into King's Cross. But the traffic went on growing, till again it overflowed. In the Exhibition year (1862) there were 1000 Midland passenger trains and 2400 Midland goods trains delayed in the thirty-two miles between Hitchin and London.

And so the necessity of independent access to the metropolis became manifest, and to-day we look back and wonder how anyone could be so blind as not to see it. The North Western has laid down four lines all the way from Rugby; the Great Northern has either three or four lines almost the whole way from Huntingdon; and they both have quite enough to do to carry their own traffic. As for the Midland, there are over 300 trains a day on some parts of the road between Leicester and St. Pancras, and, spite of a relief tunnel under Hampstead Heath and relief lines at Kettering and relief lines at Wellingbro', it taxes the ingenuity of the traffic superintendent to find room for everything. It is in fact acknowledged that the time when the line will have to be doubled for the first sixty miles out of London has already approached within measurable distance. Beyond Wellingbro'—or, to be more strictly accurate, Sharnbrook—the Company already possesses either an alternative route or else four lines of rails all the way north to the borders of Yorkshire.*

One fact seems worth mentioning in this connection. To

* [As to Midland widenings see Supplementary Chapter. 1899.]

some railway critics a line is a line, and nothing more, and they are shocked to hear that, while English railways have cost very nearly £50,000 a mile, the average in Germany is little more than £20,000, and in the United States only about £11,000. The difference, they suggest, must be due to fraud or folly, or to both combined. Such critics may be surprised to hear that of the hundred miles from Leicester to London the first half cost about £1,700,000, while the second fifty miles has implied an expenditure of about £9,000,000. The £9,000,000, it is true, includes not only the main line, but the London extensions since constructed, the goods and mineral depôts on both sides of the river, St. Pancras Station and Hotel, and similar items, all of which, however, are counted in to swell the capital cost per mile. On the other hand, the £1,700,000 allowed for the whole line as far as Hitchin, sixteen miles beyond Bedford, and for the rolling stock to work it as well. And ever since, we may venture to believe, the locomotive superintendent, who has had to find a "pilot" for the express between Bedford and Leicester every time that it is a coach or two above its usual length, and the engineer whose permanent way has been knocked about by the extra weight, and the traffic manager who cannot have the conscience to ask for a speed much above fifty miles an hour* over the Desborough and the Sharnbrook and the Kibworth "banks," have agreed in thinking that, if the Bedford and Leicester line had not been built with quite so strict a regard for economy, it would have been better both for the officers and the shareholders of the Company.

The great St. Pancras Hotel, which cost a fair slice out of the nine millions, was constructed, as all the world knows, by Sir Gilbert Scott, according to a design with which he gained the prize in an open competition. How he came, on

* The traffic manager has become unconscionable since July last. The Glasgow Express is timed to cover the 49½ miles between Bedford and Leicester, "banks" and all, in 59 minutes on the down journey and 57 on the up.

this single occasion, to compete for the construction of an hotel at all is perhaps not so well known; but London is said (and the story comes to me on good authority) to owe what is admittedly one of its finest buildings to the fact that the illness of a member of his family detained Sir Gilbert in town during the dead season. But the design with which the great architect solaced his enforced leisure was never carried out in its integrity. As originally planned, the first floor of the building was to accommodate the general offices of the Company, which were to be moved from Derby. But the great financial crash of 1867 came in to constrain the Midland Company, like everybody else, to rigid economy, and this scheme was abandoned. The hotel to-day lacks one story of its intended height, and offices and officers still remain at Derby.

The Londoner of to-day has grown accustomed to mammoth hotels. But a few years back, when Northumberland Avenue was flanked only by hoardings, the St. Pancras Hotel was probably the largest in England. And it was doubtless in no small degree its conspicuous and well-merited success that gave the impulse to later and still more luxurious developments in this direction. But it is not only hotels that the Midland has improved. English railway refreshment-rooms are by no means always what they might be. On the Great Northern, the Great Western, and the Brighton lines especially, there is still room for improvement. I travelled backwards and forwards across Lincolnshire for a long summer's day some time back, and for twelve mortal hours had to batten on buns.

But at least we have made considerable progress since the days when the tea and the soup at Mugby Junction rested substantially on the same foundation. And no line has devoted so much attention as the Midland to its refreshment arrangements, which are after all, though superior officers too often treat them as beneath their notice, by no means unimportant. Even the famous *buffet* at Avignon

would hardly furnish a dinner of six courses and coffee for half-a-crown, as is done for Scotch passengers at Normanton; while the restaurant cars on the Continent certainly cannot surpass the dinners that are served in the Manchester and Leeds expresses. I should like, however, to suggest that some English railway might do worse than make trial of the German *transportable Speiseplatten*, or trays with legs, in place of luncheon baskets. "Non omnia possumus omnes"; and it is not given to everyone to balance a mutton-chop and potatoes gracefully on his knee the while he pours himself out a glass of claret with his hands.

But after all, though we may perhaps be in advance of the Western States, in which, according to the *Omaha World*, burglars have abandoned their profession and taken to railway restaurant-keeping as less dangerous and more lucrative, we in England cannot touch the completeness of the Indian arrangements. Here is a cutting from a recent Australian paper referring to the line from Calcutta to Bombay: "The refreshment-rooms at the several places along the line were very good. For *chota-hazri* (little breakfast), which we took just after daybreak, we would have a cup of tea and some toast or bread-and-butter. Breakfast proper followed this at 9 or 10 o'clock, then tiffin at 1, and dinner about 6 in the evening. All the meals were exceptionally good. For dinner there would be, besides soup and fish, beef, mutton, snipe, duck, partridge, quail, pastry, four or five different kinds of fruits, and the universal curry and rice. The tables were laid more in the style of a first-class club than a railway refreshment-room; and there was a native servant to every two passengers who partook of meals. The guard or some other official of the train came to our carriage some fifty miles before we were to stop for tiffin or dinner and asked what wine or beer we wished to have, and he would then send a wire for it to be put in ice. The charges were for breakfast or tiffin about one shilling, and for dinner half-a-crown."

St. Pancras Terminus, with its span of 240 feet—the widest in existence,* 30 feet wider than the two spans of the adjoining King's Cross Station put together—is too familiar to need description, as far at least as its appearance above ground is concerned. It has, however, this peculiarity of construction, that it is, as it has been accurately called, "all roof." The station walls are nothing but screens to keep out wind and weather, and carry no part of the weight of the structure. The girders of the roof come down right to the ground level, where they rest upon rows of iron columns. The tie rods, to hold the girders together, are not, as in ordinary roofs, overhead, but are simply the beams on which the floor of the passenger station rests. But the passenger station is only a small part of the St. Pancras works. Underneath it there are vast cellars that must receive in the course of a year almost as many barrels of beer as there are travellers who pass through the station above. Three trains specially set apart for the conveyance of beer traffic, and more when the October brewings are on, leave Burton for London every day by the Midland route alone. Single firms reckon their storage space at St. Pancras by the acre, and their stock of barrels by the tens of thousands. Yet one stage lower, along the front of the hotel, beneath the terrace, runs an unused tunnel, through which the Metropolitan can any day they choose lay two additional lines; while, crossing and recrossing beneath the station itself, winds the Midland's own line on its way from Kentish Town to join the Metropolitan. Finally, deep down below all, the Fleet, once a river, then a ditch, and now a sewer, flows along its new subterranean bed of colossal iron drain-pipes.

A second good-sized slice out of the £9,000,000 mentioned above has gone for the erection of the great St. Pancras goods depôt, adjoining the passenger station, which even now is still incomplete. It stands upon the site of 600 houses,

* [Since this was written, Frankfort, St. Louis, and Boston South Terminal Stations have all surpassed these dimensions. 1899.]

and the upper floor—for the depôt is in two tiers—consists of 16,000 tons of iron plates, held together by rivets whose heads alone weigh 800 tons; and over it there radiate in all directions from the entrance seven miles of railway. The mere clearing of the site was the work of years; in some cases eight or ten different rights had to be bought up before possession could be taken of a single house. But the property

ST. PANCRAS MILK STATION.

was mostly in a very dilapidated condition—in one house the plant and the stock in trade of a gang of coiners was found stuffed down a drain—and Londoners need not regret that it has been swept away. Downstairs the most interesting portion of the building is that which is divided into a series of two-and-twenty small private stations, each complete with sidings, platforms, office, store-room, and cellar, with lock-up entrance from the depôt behind and exit into a

private road in front. These are intended for the accommodation primarily of wholesale potato merchants: but doubtless in some cases manufacturers, such as iron-founders, or potters, or brick or terra-cotta workers, may find it convenient to rent them as sample-rooms.

On the upper floor there is to be built an immense goods shed, 250 yards long by 40 in width, and there is already in existence a smaller station specially devoted to the milk and fish traffic. Milk and fish, as everybody knows, mostly come to London on passenger trains; and of late years the traffic has so much increased that it often encroaches in the terminus on the room required for the accommodation of passengers. Not only so, but the noise and slopping of the milk-churns and the smell and dripping of the fish are not found to exert an attractive impulse on the travelling public. The Great Eastern propose to house their milk in separate quarters when they get their new additions to Liverpool Street Station; and the Midland has already been able to do so. I was in the new depôt one morning about 12 o'clock. Alongside the milk station were rows of expectant carts; the 11.40 and 11.50 A.M. trains had just come in, and two-and-twenty van-loads of milk had been detached from them and were just being shunted into the milk station. Each truck-load averages 35 churns, each holding 16 gallons; but in the space of half an hour the milk was all gone, and the porters were calmly reloading empty churns for the return journey. The bulk of the milk, I was told, had come from Derbyshire, whose produce is specially valued by the London trade on account of its supposed keeping properties. Leaving the depôt, one cannot but notice the wrought-iron screens that separate the interior roadway from the Euston Road. Even Mr. Ruskin himself, though he might hesitate to endorse the verdict of an enthusiastic journalist, that they are "of such noble dimensions and chaste patterns as to leave nothing better to be desired for effect," could hardly deny that they are both handsome and suitable.

If it has cost the Company £9,000,000 to establish them-

selves in London, their outlet to the North, partly from the determination that the line should be as good as money could make it, partly from the fact that it was built in the years of inflated prices after 1870, has required very nearly another £4,000,000, or (including branches) £50,000 a mile for the eighty miles between Carlisle and Settle. The Lancaster and Carlisle, which was opened in 1846, in days when engineers had found that engines could round curves and climb hills that would have made the railway men of ten years earlier stare and gasp, and had not yet learnt that it might not always pay to make them do it, cost originally no more than £1,300,000 for much the same length of line. But then the Lancaster and Carlisle has not only some nasty sharp curves, but a gradient of 1 in 75 for five miles, while by the Settle route there is no gradient worse than 1 in 100.

Probably £20,000 to £30,000 a mile is the lowest sum for which any double line can be built to come up to English standards. In 1885 the Midland, taking advantage of the unexampled low price at which contracts could then be let, began to construct a short line, eleven and three-quarter miles in length, from Ilkley to Skipton, passing not very far from Bolton Abbey. The gradients are favourable, the work on the whole pretty easy; there are three viaducts, one of them long but not high and the others not of any great size, and one tunnel of about a furlong. The estimated cost amounts to nearer a half than a quarter of a million. The first portion of this new branch was opened last spring, and a cry was then raised in some quarters that Bolton Abbey would be desecrated by a railway being brought close to it. Perhaps therefore it may tend to reassure timorous Wordsworthians to learn that the Duke of Devonshire, who might be supposed to take some interest in the preservation of the beauties of the spot, did not oppose the construction of the railway.

The line is now opened throughout, so it is too late for anyone to visit it who wishes to watch the actual process of

railway building. But it is worth going to Ilkley if only in order to breathe the air, which, even if it be not, as the natives declare, the finest in the world, certainly does not fall far short of that high distinction. Moreover, short and unimportant as the line is, it is a perfect microcosm of railway construction. Let anyone walk along the line—the trains are not as yet over-numerous—and see how in one place the cutting is carried through the most obdurate of all obstacles, the boulder-clay: how, a little further on, the peat has been dug away to afford a solid foundation; how, in a third place, the embankment has been floated on brushwood, as Stephenson floated his famous road across Chat Moss. Let him notice the elaborate drainage, lest water should lodge anywhere to undermine the security of the permanent way; notice too the substantial stone bridges, in some instances not more than 200 yards apart, built for the convenience of a few sheep or an occasional farm cart, because even this is cheaper than the price that must otherwise be paid as compensation for severance; and then he will have observed at least one reason why English railways are beyond all comparison dearer than those of our Continental neighbours. Then let him reflect that the working expenses of the traffic that is to be will swallow up half the gross receipts, and that therefore the railway manager, if he is to earn 5 per cent on the new capital, must succeed in creating new traffic worth £2000 a mile, or £40 per mile a week, and he will hardly go away without feelings both of admiration and sympathy for the men who grapple, and grapple successfully, with tasks like these.

A twelvemonth since, however, a visitor inclined for exercise of a more active kind than mere walking might have mounted upon one of the small "pug" engines that the contractor had at work, and practised holding on while it skipped and bounded at the rate of fifteen miles an hour over the uneven surface of the temporary road. When the writer was there one of the engines was standing with a train of empty tip-wagons between it and the direction in which we

wished to travel. There were no points, or means by which it was possible for the engine to run round, and so get rid of them. However, up we got, and set off with the wagons dancing away merrily in front of us. At one point we came to a gap that had been cut in the rock only just wide enough to allow the passage of the train, and as truck after truck rose over the opening, and then pitched down abruptly on the further side, it looked for all the world as though the train was a flock of sheep that we were chasing through a gap.

But the most uncanny sensation was to be experienced at the Skipton end of the line, where the tunnel was in progress. Arming ourselves with dip candles stuck in lumps of wet clay, we pushed our way through pools of mud and water, past the loaded trucks that were drawing out the "spoil" over or under the scaffolding from which the bricklayers were putting in the lining, on to where the navvies were working away at the face with pick and crowbar, with boring rod and blasting powder. Nor did the sickly smell of the powder, the oppressive gloom which the smoky glimmer of innumerable dips only rendered more oppressive, and the steady and filthy drip, drip, from the roof above avail to quench our ardour of exploration, till we had crawled forward into the heading that was being driven to meet the works undertaken from the other end. After this crowning experience of tunnel excavation, one fancied one had gained at least some faint conception of what it must be to work in a tunnel miles away from the opening and the light of heaven, whether it be in the bowels of a mountain like the Mont Cenis or the St. Gothard, or with a great river like the Severn or Mersey swirling over one's head.*

* Except for the purity of the atmosphere, a walk through the Mersey or the Severn Tunnel is nowadays in no way different from a walk along the Metropolitan Railway, though in the Severn Tunnel the crawl through the heading from the tunnel to the pumping shaft over the great spring is not without power to impress the imagination; but those who wish to appreciate the every-day heroism of the ordinary navvy will not fail to read Mr. Walker's graphic account of the stampede when the shout rang through the workings that the river was "in."

The Midland have, however, just undertaken a new piece of tunnel construction on a very different scale. To anyone but those who are well up in the geography of the British Isles—and there are not many people who can honestly claim this distinction—it sounds rather startling to be told that the Company is going to spend about £1,000,000 sterling in order to connect the insignificant village of Dore with the equally insignificant village of Chinley by a line 20 miles in length, and traversing on its course 5½ miles of tunnel. But when we come to realise that Dore means Sheffield, and Chinley Manchester, the matter assumes a somewhat different complexion. Most of us know that the Pennine range runs down the centre of the northern part of England, terminating in the Peak district of Derbyshire. In and about the latitude of Manchester there are only two railway passes through these hills from east to west. The one is from Leeds through the Stanedge Tunnel, 3 miles in length, and is in the possession of the North Western; the key to the other is the Woodhead Tunnel, only a few yards shorter, belonging to the Sheffield Company. Now the Midland system resembles in shape an open pair of scissors. The handles are at Bristol and London, they meet at Derby, and the blades point, the one towards Manchester and Liverpool, the other to Sheffield and Leeds and the North. The handles are so far apart that a Midland line to unite them is an impossible dream. But not so with the blades. Sheffield is 41 miles from Manchester by the existing Manchester, Sheffield, and Lincolnshire road. By the new Midland one the journey will be only 5 miles further. And it need not be said that there is a good deal of traffic worth fighting for between these two towns, in both of which the Midland is already well established.

The game is without doubt a good one, but, as has been said already, the candle for it will be by no means inexpensive. The new line starts from Dore, 4½ miles south of Sheffield on the main line to the North. Running due west, it dives under the Duke of Rutland's famous Longshawe Moors in a tunnel 3½ miles long, the longest in Great Britain after the

Severn Tunnel, and striking the valley of the Derwent—the "Darwin's rocky dales" of Macaulay—a little north of Chatsworth, follows its course for 4 miles, and then crosses the river and continues up the valley of its tributary, the Noe, for 8 miles more. Then another dive through the caverns of the Peak, with a tunnel this time $2\frac{1}{4}$ miles in length, and the line emerges to form a junction at Chinley, some half-a-dozen miles north of Buxton, with the present Derby-Manchester line. It is not so many years back that this latter line was closed for many weeks by a landslip at one end of the Dove Holes Tunnel; if anything of the same kind were to happen again, the Midland would not be sorry to have in the Dore and Chinley an alternative and scarcely longer route to Lancashire. But we are hardly likely to see it open for traffic before the year 1893. Meanwhile, in Manchester itself, the Midland, in conjunction with the Lancashire and Yorkshire, has been improving a line round the city, which has enabled them to run through from the South into the Victoria Station, and thence onward, without change of carriage, to Bolton and Blackburn. From Victoria the Midland already work their own trains out North *viâ* Hellifield to Scotland, and it is said to be not unlikely that before long some of the expresses from London, or at least from Bristol, to Scotland, will travel *viâ* Manchester instead of by the present Erewash Valley route.

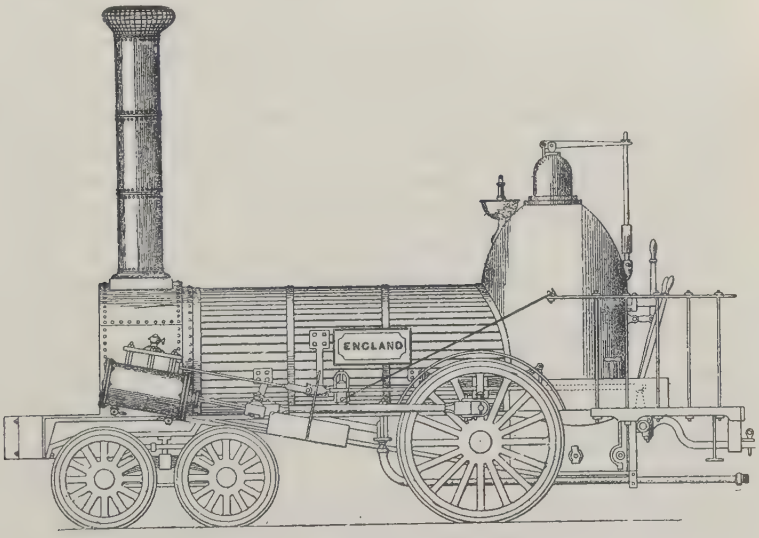
The Midland branch from Bristol to Derby, originally the property of three separate companies, to say nothing of the Cheltenham and Gloucester Tramways, which were bought up by the Gloucester and Bristol, is undoubtedly the most important line in Great Britain not terminating in the metropolis. And now, since the competition of the New Severn Tunnel route has smartened up the service all round, its express service is worthy of its immense importance. But of this we shall have more to say later on. Meanwhile let us notice its other titles to fame. It was over the body of the Gloucester and Bristol, originally constructed by Brunel

as a broad gauge line, that there was fought one of the fiercest conflicts in all the long Battle of the Gauges (which began exactly half a century ago last autumn). The conflict resulted in the Midland carrying off the prize from under the very nose of the Great Western, much as a generation later, in conjunction with the South Western, it carried off the Somerset and Dorset, and almost succeeded in capturing the Bristol and Exeter. The North Western, according to Mr. Williams, showed its gratitude to the narrow gauge champion by admitting Midland trains into New Street, Birmingham, for a nominal rent of £100 a year.

The line has another title to fame in the fact that the Lickey incline above Bromsgrove is the steepest bit of railway on a main thoroughfare in Great Britain. The Cowlairs Tunnel down into Queen Street, Glasgow, has a gradient of 1 in 42, while on the South Devon there are little bits of 1 in 40 and 41, and several miles of 1 in 42 or 43. But down from the Lickey hills there is a descent of 2 miles at the rate of 1 in 37. And the most remarkable thing is that it has always been worked solely by locomotives. In days when stationary engines were thought necessary to drag the trains up from Euston and from Lime Street, Liverpool, the proposal to do without them at Lickey was not a little startling to engineers. George Stephenson and Brunel roundly declared that it would be impossible. And apparently they were right, as far at least as English locomotives were concerned. For Mr. Bury, a famous engine-builder of the day, sent an engine which not only could not draw a train but actually could not take its own weight up the hill.* But a

* I tell this story on the authority of Mr. Williams. But Mr. Williams has an odd mistake as to the size of the 'England's' driving wheels, which he gives as 2 feet in diameter. Both by Captain Moorsom in two papers read before the Institute of Civil Engineers in the sessions of 1840 and 1842, and also by Whishaw, from whom the illustration in the text is taken, they are given as 4 feet. The engines which succeeded the 'England' were considerably more powerful. She had a boiler 8 feet in length, with 78 tubes, and 10½-inch cylinders. The 'Philadelphia' class had 9 feet boilers, with 94 tubes, and 12½-inch cylinders.

set of engines built by Mr. Norris of Philadelphia, which had been imported at a cost of from £1500 to £1600 apiece "including the duty of 20 per cent.," succeeded in performing the task successfully. Oddly enough, they were in no sense designed for this special work. The specification was for "engines of a higher power, greater durability, and less weight, than could be obtained in this country," and they were to be tested to prove their capability of drawing "up



AMERICAN BOGIE ENGINE (DATE 1839).

a gradient of 1 in 320 a load of 100 tons gross weight at the speed of 20 miles per hour, and up a gradient of 1 in 180 a load of 100 tons gross weight at a speed of 14 miles an hour." The steam pressure was about 60 to 64 pounds. It is interesting to see that even at this early date—the first of these engines were delivered in the spring of 1839—the American builders had struck out a line of their own. The engines, as may be seen from the illustration, had a bogie-truck forward, they had also chilled cast-iron wheels, those of the bogie (which were 2 ft. 6 in. in diameter) without tires, and an

iron fire-box. This latter, however, after eight months' work had to be replaced by an ordinary copper one.

The 'England,' the first of her class, when tried on the Grand Junction, failed to comply strictly with the stipulated conditions. Thinking them, however, "good, serviceable engines," Captain Moorsom succeeded in introducing them upon the Birmingham and Gloucester. Here, in the course of a short time, they underwent a complete transformation. As originally built, the engine, when empty, weighed 8 tons; but by suppressing the tender, constructing a tank holding 400 gallons of water, to be carried on the boiler of the engine, and also arranging the supply of coke in sheet-iron boxes upon the foot-plate, the weight upon the driving wheels was increased to upwards of 10 tons. Further, not only the waste steam, but also a number of pipes from the smoke-box were led into the tank, and maintained the water in it, at boiling temperature. "The general summary of the work shows that with a maximum load of 8 wagons and 20 men, making a weight of 53¼ tons behind the tender,* the 'Philadelphia' ascended the Lickey inclined plane at a speed of between 8 and 9 miles per hour. That with 6 wagons, or 39½ tons, the speed was between 10 and 11 miles per hour; that with 5 wagons the speed increased to between 12 and 15 miles per hour, and that in assisting the ordinary trains, with 7 passenger carriages, the usual speed has been 13½ miles per hour." The cost of working for the entire year 1842, with 1600 trips of 13,000 miles, amounted to £1300. Considering that the Cowlairs Tunnel, of only half the length, cost £1500 a year to work, that that down into Euston at a gradient not much more than one-third as steep cost nearly as much, while even the Box Tunnel plane accounted for over £2500, the Birmingham and Gloucester directors had certainly every reason to be satisfied with this result.

Whether the directors of the Midland have as good reason nowadays to be satisfied of the wisdom of ever climbing the

* *Sic* in original; but, the tender having been suppressed, "behind the engine" would have been a less misleading phrase.

Lickey hills at all, is a different question. Modern engines have not increased in power faster than modern trains have increased in weight, and the Lickey incline implies to-day the constant maintenance of five "banking" engines to work it. Five engines at the most moderate estimate mean £5000 a year, a sum which, if capitalised, would buy up a good deal of property in the very heart of the town of Bromsgrove; for the line, it should be said, was constructed in its present position in order to economise in the matter of land. Nor is expense the only thing. For the two miles between Blackwell and Bromsgrove seven minutes is allowed even by the fastest express. Every train going west, for all its continuous brakes, must stop at Blackwell to pick up a brakesman, and then stop a second time at Bromsgrove to set him down again. On the return journey it must stop at Bromsgrove for the banking engine to join on behind, and then pant slowly and laboriously up the hill. As for goods traffic, if anyone wants to see brake-blocks on fire, let him ride down the Lickey incline on the tail van of a heavily-laden coal train, with the side-brake of every second truck pegged down as tight as the brakesman can fasten it. But, unless he has exceptional confidence in his own uprightness, let him not stand at ease when the driver finds it necessary to check the momentum of the train by a sudden application of the steam-brake.

But our business is not so much with the anatomy of the Midland as with its circulation. Let us come at once to the heart of the system, where the "traffic-blood," as Mr. Williams calls it, pulsates in the fullest and most ample streams. But how to describe the engorgement of the aorta? At Chaddesden, Toton, and Beeston, all of which are within a few miles of the Midland capital at Derby, about 200 miles of trucks are sorted each week. Let me sketch the process as I first saw it. We left Derby Station on an engine, about 8 o'clock in the evening of a bright day in July. As there were on the footplate not only the driver

and his fireman, but one of the chief officers of the line, an inspector, and the writer, there was naturally not over-much room; but it had been agreed that, if a saloon were attached, it would only be in the way in the devious course that we proposed to traverse. Fortunately we were going neither far nor fast, and there was little need for the fireman to ply his shovel.

The first point for which we made was Chaddesden, only about a mile outside the town, where the goods traffic converges from every point of the compass, and is rearranged, made up into fresh trains, and again sent forward. Here a train arrives and leaves every seven and a half minutes throughout the twenty-four hours, and of course at much shorter intervals in the early evening. As Nature has not been kind enough to provide a convenient slope like that at Edgehill,—and indeed as the traffic goes away in both directions instead of being mainly outwards, as in the case of Liverpool, it would be necessary to provide not one slope but two,—another method of sorting has to be adopted. A train arrives, its engine is uncoupled, and a second or shunting engine is attached at the back. This new engine then pushes the train forward to a shunting-neck, which opens out into no less than thirty-five lines.* The couplings between the separate "shunts"—the single trucks, that is, or sets of trucks for the different destinations—are meanwhile unhooked; to each shunt one or more horses are attached, and the trucks are by them drawn forward into their appointed siding.

A train of forty trucks is in this way broken up in from three and a half to four and a half minutes. Six engines

* An American correspondent writes to complain of the ambiguity caused by the use of the same word "line" both for an entire railway and also for each separate track, and to express his desire to see the "simple and concise expression 'track' introduced into England." If there be any obscurity in the text, it is the fault of the writer, who desired to use the popular expression, and certainly not of the poverty of the English railway vocabulary. A railway man would call them neither "lines," nor "tracks," but "roads."

and from fifty to a hundred horses are constantly at work here, and the cost of working was stated some years back to amount to upwards of £27,000 per annum. When we were there on a fine summer's evening the work was easy enough, but I was assured that in cold winter weather, with the grease frozen in the axle-boxes of the trucks, instead of one horse to three trucks, the proportion was often three horses to one truck. When to frost there is added the yet more cruel impediment of a fog, the work becomes sometimes almost more than flesh and blood can stand. But it is got through somehow, though how they do it is more than the men themselves can tell.

Chaddesden seen, we remounted our engine and steamed to the further end of the sidings, our inspector, who seemed to know exactly what point on the line each particular train would have reached at each particular moment, assuring us that we might get away as soon as the so-and-so "passenger" had passed, and run out in front of the "goods" that was booked to follow it. But the first thing to be done was to draw up opposite the signal-box, and tell the signalman who we were and what we wanted; for, though signals drop on the approach of a regular train as readily as the turnpike gates flew open before the advent of John Gilpin, a very wilderness of red lamps affronts the gaze of the unexpected intruder. We explain our mission; we are bound for Toton, some ten miles off, which, though Bradshaw know it not and the published time tables be ignorant of it, is yet one of the largest railway centres in England. The man signals to the cabin in advance; one beat on the bell of the block instrument to call attention; one beat comes back in reply. He answers with five beats—"Be ready; 'light' engine coming." The advance cabin repeats the signal; says, that is, in railway language, that the section is clear, and he is ready to receive us; the signal-arm drops, and off we speed into the night. In a few minutes we are at Trent, where, according to Lord Grimthorpe, the bewildered passenger is wont to see red lights glaring in front of him, and to shrink

in momentary expectation of a collision, till his fellow-passenger calms his fears by telling him they are only the tail-lamps of his own train. But, whatever the curve may be, it is not sharp enough to bring the tail-lamps of our tender before our faces, and the signals are off for us to pass through and up the Erewash Valley line; so we stop but a moment to hand out a bag and a hamper we had brought with us, and a mile or two further brings us to Toton.

Chaddesden deals mainly with goods traffic: Toton is concerned almost wholly with minerals. Unfamiliar as its name may be, if the coal that is burnt in our London fires could speak, well-nigh half of it would acknowledge its acquaintance with the place. For it is here that the bulk of the produce of the great Derbyshire and South Yorkshire coal-fields is collected and made up into trains ready for despatch southwards. Here the Company has the natural lie of the ground in its favour. The coal comes down the gently sloping valley of the sluggish river in full loads, and back up the hill again the engines have nothing to haul but the empty wagons. Right through the middle of the sidings runs the main line to the North, with four sets of rails, one pair for passengers and one for goods; and no truck, whether full or empty, may venture, without urgent cause, to trespass upon the passenger lines. On the up side of the line the full trucks are sorted; on the down side the returned empties, with an independent staff and different engines. Here too the engines are helped by horses, and it is curious to watch how the clever beasts never put their shoulders to the collar till the engine has "hit up" the trucks and started them. And so, heavy as the work looks, they are none the worse for it; one fat and contented-looking old mare, who seemed to have plenty of work still left in her, has, says the foreman, been here fifteen years already. As there are about fifty horses engaged, and between three and four million tons of coal pass through Toton in the course of a twelvemonth, we calculated that that old mare must have

hauled a million tons of coal in the course of her useful if uneventful life.

The Toton stables contain not only fifty horses, but seventy engines, which work the trains from here to Wellingbro', half-way on the main line to London, as well as to Peterborough, to Rugby, and to Birmingham. In the engine-drivers' strike in August, 1887, Toton was one of the leading centres of the movement. Strangely enough, at Wellingbro', a precisely similar position, which finds the engines to work the coal forward to London, hardly a man left his post. But the Midland drivers never had a chance of success, and though Friday and Saturday, the two first days of the strike, during which 18,000 telegrams passed through the station office at Derby, was an anxious time for the officials, it was evident from the very first that the passenger traffic could be kept moving, and, if that was done, the rest was easy. There were scores of miles of sidings round Derby where goods and coal wagons could be left standing till fresh men were obtained to work the trains; if need were, one line of the less important branches could be pressed into the service as a continuous siding, while the traffic could be worked through on the other. But in fact it was only for about two days that even the goods service was seriously disorganised. At Tibshelf Sidings, a place sixteen miles further than Toton up the Erewash Valley, which deals with some forty trains a day, there was not a single truck that was not cleared off by Sunday morning.

There have been certainly two much more determined drivers' strikes in England, and in both of them the men were beaten. In 1849 every driver on the Eastern Counties struck work in support of a comrade who was fined a shilling and refused to pay it. "Within nine days," writes Sir Cusack Roney, who was the principal officer of the Company at the time, "almost all the usual trains were restored to the time table." What happened to the goods trains we are not informed, but doubtless the goods traffic of the Eastern Counties forty years ago was not a very formidable matter.

Again, in 1867—to say nothing of a strike on the Brighton which only lasted two days—there was a great strike on the North Eastern, and only half-a-dozen men stuck to their post on all the lines of the system north of Darlington.

Tibshelf was too far off to be visited on this particular night. But I spent some hours there on another occasion, and the place deserves a word or two of notice. The sorting of the trucks, which in this case is not a very complicated process, as the collieries which feed the lines, though large and important, are not numerous, is done by gravitation. There are eight standing lines, to say nothing of a separate line for "cripples," *i.e.*, damaged trucks: each of the lines is long enough to contain two trains, and the trucks are allowed to run into them from the upper end, down gradients ranging from 1 in 60 to 1 in 90, and are then drawn away to their destination from the bottom. We visited one of the collieries a few hundred yards off on a private siding. A stranger sight than we there witnessed it has seldom been my lot to see. As the coal came flying up the shaft from the workings below, the corves were emptied straight down a shoot on to a wire screen, with a mesh of one inch, or thereabouts, that was travelling with a quick, jerky motion in an endless band round rollers some 4 feet long and perhaps 20 feet apart. Down each side of the screen were two rows of boys, twenty-six in all, tiny little fellows of ten and eleven, naked to the waist, and as black as niggers, except where here and there a patch of white skin had refused to catch the dye of the all-pervading coal-dust. Their business was to seize each lump of shale or dross as it passed them on the screen, and throw it off over their shoulders on to a heap behind. The slack, of course, falls through the screen of its own weight, and then the coal that is left is discharged into the railway wagons at the further end. The little chaps, we learnt, worked from 7 till 1, and earned one shilling. "How about the Education Act?" we asked, and were informed in reply that these embryo rulers of the British Empire had already completed their education, and having passed the

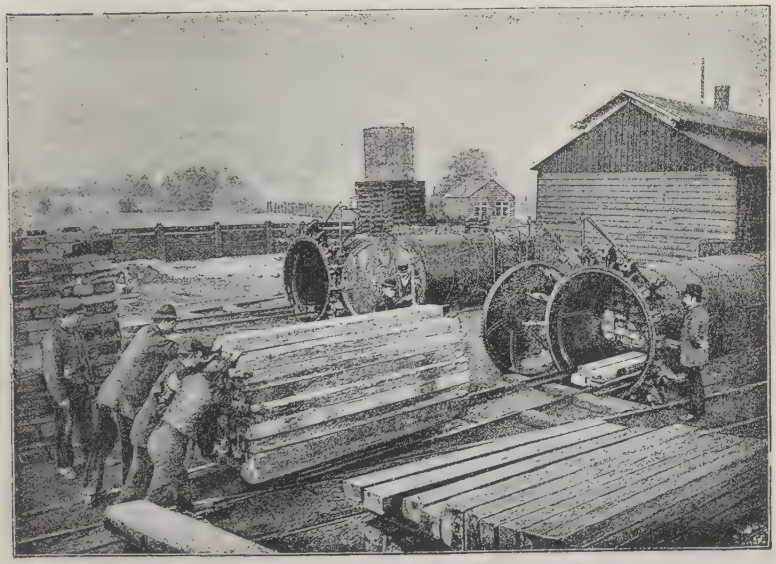
Fourth Standard were exempt from the necessity of further school attendance.

But we must get back to our engine, which, after a series of successful but complicated manœuvres, is now standing on a convenient siding ready to escape at the first favourable opportunity. Our next destination is Beeston, a mile or two to the west of Nottingham, which performs for the Nottinghamshire coal coming down the valley of the Leen, a stream which rises in the grounds of Newstead Abbey, the same functions that Toton performs for the collieries of Derbyshire and South Yorkshire. The work here is done entirely by engines, which puff monotonously to and fro, and so lacks the life and animation that the movement of the horses and the cries of their drivers lend to the operations at Chaddesden and Toton.

At Beeston also there was more to see than could be visited that night. If the Midland Railway should wish any day to make a bonfire of the thousands of tons of coal that are generally to be found here, assuredly they would not lack for wood with which to kindle it. For at Beeston are the works in which the sleepers are prepared for use, by being impregnated with creosote to preserve them from decay. The foreman's books showed that on the day I visited the place there were about 120,000 "white" or uncreosoted sleepers in stock, and that 196,000 had passed through the place in the preceding twelvemonth, but in a good year the number rises to 250,000. They are stacked for about eight or ten months to dry, and then taken in hand. The first process is to place each sleeper under a press, which sends down upon it two arms, 4 feet 8½ inches apart, each arm provided with four drills, which, in a moment, bore out the holes to receive the bolts and "trenails," to fasten down the chairs. On the North Western the custom is to fix the chairs on the outside of the sleeper, and to cut out with an adze a shallow depression to receive them. On the Midland the chairs are set flush on the inside of the log.

Passengers who roll smoothly over the main line of one of our great railways at sixty miles an hour do not half recognise the difference between their almost imperceptible motion and the jolting and jiggling of most of the Continental expresses. Still less do they think of the infinite solicitude and the unceasing attention to minute detail by which the perfection of English permanent way has gradually been attained. Here is another point of difference between North Western and Midland practice. The Midland have hitherto, for I believe they have lately seen reason to change their minds, inserted the "key"—the oak wedge which holds the rail tight in the chair—on the inside, the commoner custom being to put it on the outside. Their reason was, that if a key got loose and fell out, as must occasionally happen in hot, dry weather, the rail would still be kept in place by the pressure of the neighbouring keys. If, on the other hand, an outside key was missing, it would be possible for the rail to be bent outwards at that point, and so to throw the train off the line. The opposition argument replies with the assertion, which is undoubtedly true, that the system of outside keying secures the insertion of a soft and yielding substance between the hard iron of the chairs and the yet harder steel of the rails, and so renders the road, when struck by the tremendous blows of the driving-wheel flanges, both more elastic and less noisy. If anyone wishes to be convinced that the operations of the "Way and Works" department are not without interest to the travelling layman, let him close his eyes, as the 'Flying Scotchman' speeds through Doncaster on its way to the North. He will need to be exceptionally dull of hearing, if he fails to notice the point at which the train passes from Great Northern to North Eastern territory. Of course, as far as steadiness and safety are concerned, the one road is not one whit more perfect than the other. But the North Eastern finish off the ballast level with the top of the sleepers, leaving the chairs bare and the rails that they carry suspended in mid-air; the Great Northern bury the sleepers entirely, and pack the ballast on the

outside, almost flush with the head of the rail. The difference in noise and vibration is simply enormous. I have lain awake before now, coming up in the "sleeper" from Edinburgh, tossing uneasily from side to side till three o'clock in the morning, and then dropped off sound asleep as soon as the train got on to the noiseless Great Northern line.



CREOSOTING SLEEPERS AT BEESTON.

And now for the sleepers,

Such as rest on the Northern or Midland line

habitually. As soon as the holes are bored, they are loaded on to small narrow-gauge trucks, and securely fastened down with chains. Of these trucks there are six in a "set," each truck taking forty-five sleepers; and this mimic train-load, with the help of a few odd sleepers packed in loose between the rails under the trucks, just fills the creosoting cylinder, a great iron tube some 50 feet in length by 4 or 5 feet in diameter. As soon as the train has run into the

cylinder, the wrought-iron door is closed and screwed firmly shut, and then the pumps are set to work, to pump the air out. This done, and a vacuum obtained, a tap is turned on, and creosote flows in from an adjoining tank to fill up the empty space. Then the pumps go to work again, this time not to exhaust the air but to force in more creosote, which they do with a pressure of 120 lbs. on the square inch. They are kept at work till the gauge shows that about 700 gallons more than the quantity necessary merely to fill the cylinder has been pumped in, or, in other words, till each sleeper has absorbed into its fibre about $2\frac{1}{2}$ gallons: then the pumps are stopped, the unabsorbed creosote is allowed to run back into the tank, the door is opened, and the trucks drawn out. When the sleepers have had time to drip, they are ready for use. In summer, when the wood is dry, the operation only takes about an hour and a half. In wet weather, and still more when the sap is frozen in the wood, it takes far longer. Four or five "sets," of 300 apiece, are sometimes dressed in the course of a busy day. A sleeper, 9 feet long by 10 inches wide and 5 thick, when new costs about half-a-crown. The expense of creosoting brings its value up to 3*s.* 3*d.* On a well-drained road it may last twenty years, and when it is done with it ought to fetch 1*s.*, either as firewood or for fencing purposes.

From Beeston we steamed back to Trent, whence the writer was to return to London. It was past 3 o'clock, and dawn was just breaking; so, after a short interval, during which we explored the contents of the hamper that the care of the inspector had provided, the engine with the rest of its occupants returned to Derby, and the writer was left to wait for the 'First Scotch,' which was due to arrive at 4.36. To his disgust, it was telegraphed as 45 minutes late *ex* Carlisle.* At 5.22 in came two huge engines with

* There will be more to say presently about the punctuality of the Scotch expresses. The down trains and the up day expresses generally run to the minute, but it is impossible to say as much for the up night trains. For this there are two reasons, of which the one is to be found in

twenty coaches behind them. Dropping the "pilot," we ran along the level valley of the Soar to Leicester, saving one minute *en route* off the allotted time. We started from Leicester at 5.56, needless to say with a "pilot" on, as we were booked to run without stopping the 99¼ miles into London in only two minutes over the two hours. Leaving the flat meadows at Leicester, we were to climb to 368 feet above sea-level at Kibworth, to drop down again to Market Harbro'; up the great Desbro' bank to a height of 435 feet; down again to Wellingbro', and up again once more over 300 feet at Sharnbrook Summit, only to descend again to the marshy levels of the Ouse at Bedford. Then another long steady pull, till at Leagrave, above Luton, we are once more 367 feet above sea-level, and our run down the incline past St. Albans only leads to an equal ascent to bring us up to Elstree, and, when at length we get a long straight course downhill, it is just at the point where the growing accumulation of the London traffic renders any hope of exceptional speed impossible. But of all this the other passengers were probably on this occasion as blissfully unconscious as the writer.

When, however, I tumbled out of the carriage on to the platform at St. Pancras, and raised my eyes to the big clock, my first impression was that I was still dreaming. The hands said 7.53, but I refused to believe them till my own and the guard's watch confirmed their tale. We had come from Leicester, 100 miles all but three-quarters, over one of the hardest courses in England, in three minutes under the two hours. The mere speed on paper is only a fraction short of fifty-one miles an hour, but, when we allow for gradients

the number of connections, many of them off single lines, that have to be made north of the Border, and the difficulty of getting through Perth Station; the other is to be found in the convoys of fish that are often handed to the Company at the very last moment. Three or four truck-loads, one truck possibly to be put off at Sheffield, a second at Trent, and a third at Leicester, may be enough to render punctuality out of the question. And yet the Company can neither afford to lose the traffic, nor to run a special train for the sake of four trucks.

and the weight of the train (pilot engine though there might be), it was a performance that could hold its own even by the side of the magnificent burst that brings the Great Northern over the 105½ miles between Grantham and London in precisely the same space of time.*

Some days afterwards I had the opportunity of examining the guard's journal—for of every train on the line the guard, at the end of its journey, sends into head-quarters a detailed record, specifying what vehicles were on the train, and where they were attached and detached; what delays, if any, occurred, and by what they were occasioned: where engines were changed, and anything remarkable that may have happened. From the journal it appeared that the train was delayed one minute at Normanton and one minute at Finchley by the signal being against it, so our run ought really to have been one minute faster.

But what the journal could not show was yet more remarkable. Past all the other hundreds of signals along its course our train had run unchecked. And yet, seeing that it was three-quarters of an hour after its time, its proper place in the time table must have been filled with goods trains and mineral trains that were booked to leave every junction and every refuge siding all along the line a few minutes after the time at which it ought to have passed. As long as the times of a train on the main line near London

* I intentionally leave the text as it was written a year ago. My journey was on July 16th, 1887. In July, 1888, the day Scotch express was covering the same course in 2 minutes less on the down journey and 3 minutes less on the up, six days in the week, while a week or two later the Great Northern time to Grantham had also fallen to 115 minutes. That a speed, which in 1887 seemed so wonderful—and, to show that I was not in error in so regarding it, I may say that the officer most conversant with the question told me that he had disbelieved my statements till he sent for the guard's journal—has become in 1888 an every-day performance, is as good evidence as could well be asked for to prove that 1888 is an epoch in English railway history. I ought, however, to add that, in Mr. Rous Marten's recently published "Notes on the Railways of Great Britain," there are records of two still faster runs—St. Pancras to Leicester with one stop in 113, and Leicester to St. Pancras with two engines and 17 coaches in 112 minutes.

depend on the single-line working of some Scotch company 500 miles away, absolute punctuality (especially at fifty miles an hour) is, of course, unattainable. Thanks, however, to the block system, unpunctuality is no longer, as it used to be, a source of serious danger; but it says not a little, both for the perfect discipline and carefully thought-out regulations of our railway management, and also for the prompt intelligence of the men themselves, that out of three hundred signalmen in three hundred cabins, where they reign as undisputed sovereigns, not one fails to keep a clear road for the express, come when it may, and this without so delaying the ordinary traffic as to render it unworkable.

The strength of a chain is, in the old phrase, only the strength of its weakest link, and the safety of the 700,000,000 passengers who travel in Great Britain every year simply depends on the intelligence, sobriety, and care of each individual among the 300,000 *employés* of the companies. When discipline, organisation, and mechanical appliances have done their utmost, the fact yet remains that each time we enter a train life and limb are at the mercy of every driver and pointsman along the line. And in 1887 there was but one single train accident by which any passenger lost his life. And yet, though drivers and pointsmen are simply samples of the stuff of which the rest of the English working classes are composed, we prate of the decadence of English character and the degeneration of the fibre of English manhood.

But we must not be led away at this point to sing the glories of the great English expresses. We have not yet come to the Great Northern; and a dissertation on speed which ignored the Great Northern would be, not perhaps *Hamlet* with the part of the Prince of Denmark omitted—for not only the Midland, but also the North Western, have claimed the right to rank as protagonists since last summer—but at least an *Iliad* without a Hector. So let us return to Derby, and, humbly making our way on foot through the

shops, let us see where the iron steeds are born and reared. As we enter, one of them is just coming out, bright in his owner's colours—red, with black and yellow hoops—for his first race. In orthodox fashion the first step is to weigh out, only in this case it is the horse that is weighed as well as his rider. And here we fear the metaphor will serve us no further. The engine runs on to a long weigh-bridge divided into four parts, the front half carrying the four small wheels of the bogie truck, the third portion the driving wheels, and the fourth and last the trailing wheels that are coupled to them. Alongside is a small building with glazed front, and inside are four corresponding standards, each with a lever arm on either side. So in this way can be recorded not only the exact weight upon each pair of wheels, but also how much of that weight is borne upon the right-hand and left-hand wheel respectively. Of course, the two sides should be equally balanced, but otherwise the weight is by no means intended to be distributed in what the lawyers would call equal undivided third parts. Say the engine weighs forty-two tons, sixteen tons of this ought to be on the driving axle, about three tons less on the other pair of coupled wheels, leaving another thirteen to be carried by the bogie in front. A less weight on the driving wheels would diminish the power of the engine, while more would be too severe a strain for the permanent way and the under-bridges. The engine we saw had over twenty tons on one axle, and so had to go back to the shops and get the screws that regulate the springs adjusted. An ingenious person calculated the other day that the average price of an engine is about $3\frac{1}{4}d.$ per lb. all round. Considering that a locomotive consists of upwards of 5000 pieces, which, in Robert Stephenson's phrase, "must be put together as carefully as a watch," it cannot be denied that the price is strictly reasonable.

If it was impossible to attempt a detailed description of Crewe, a description of Derby is a treble impossibility; for the Midland has got all its eggs in this one basket, and

Derby is Crewe, and Wolverton, and Earlestown all rolled into one.* Let me briefly notice one or two points that struck me. In the old days, when the load was heavy or the rails were greasy, it was the duty of the fireman to clamber along the front of his engine and sprinkle sand upon the rails to increase the "bite," and many a poor fellow lost hold with his numbed fingers, and fell off and was run over while doing so. Of late years in every engine shed is a furnace for drying sand, and the dry sand is conducted from a box above the wheel-casing down to within an inch of the front of the wheels through a pipe that can be opened or closed from the footplate. But dry sand may blow off the rails and so be useless, or again the pipe may clog; and to meet this the new Midland engines are fitted with a steam jet that forcibly drives the sand down on to the rails exactly in front of the tread of the wheel.

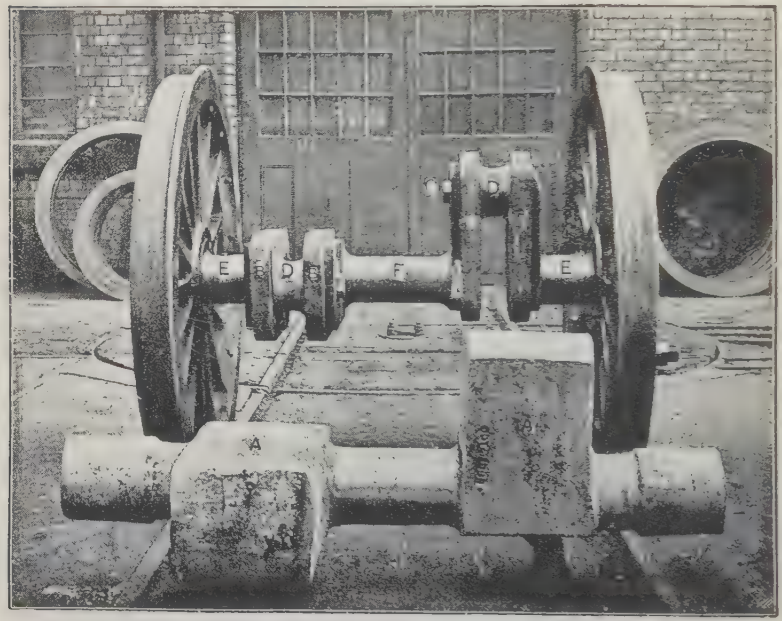
I was on one of the new 7 feet 6 inch single-wheeled engines the other day on which this apparatus was fitted, and, so far as I could judge, it worked admirably. Certainly the wheel did not slip half a turn all the way from the St. Pancras platform to Nottingham. And, if an engine will slip anywhere, it is when it starts up a hill through a clay tunnel with a huge traffic. All through the tunnels near London the sand-blast was kept going. I asked the driver if he did not use a great deal of sand. His reply was that a couple of pailfuls would be more than enough to take him to Nottingham and back again.

The engineers, however, on the St. Gothard, and also the manager of one of the Welsh railways, have advanced beyond this point, and have adopted a steam jet, not in addition to, but in place of, the old sprinkling of sand. For, strange though it may seem, it is yet a well-known fact, that, while an engine can only drag half its normal load on rails that are merely damp, as soon as they become wet it can draw what is practically its full load again. The jet

* There are, however, auxiliary wagon-works, employing nearly six hundred hands, at Bromsgrove.

of live steam has another advantage, that it melts any snow that may be lying on the track.

Schiller has celebrated in immortal verse the casting of a bell; a more recent writer has sung "The Forging of the Anchor"; railways are accounted prosaic, but a poet might do worse than choose as his subject "The Forging of the Crank-Axle," for trains occupy in the minds of most of us



A CRANK-AXLE.

A. Throws.
B. Webs, with hoops shrunk on.
C. Head of bolt through pin.
D. Pins.
E. Journals.
F. Position of eccentric-sheaves.

a far larger place than ships, and a ship is far less dependent upon its anchor than is the safety of the train upon the crank-axle of the locomotive. Not that all locomotives, by any means, have a crank-axle at all. Outside-cylindered engines can connect the piston directly to the boss of the driving wheel, and except in Great Britain outside-cylindered

engines are almost universal. But here the common practice has been, for weighty reasons that we must not now stop to consider, to put the cylinders inside the framing of the engine; and, though of late there may have been a slight reaction on some lines in favour of outside cylinders, the great bulk of our locomotives have inside cylinders—are driven, that is, by connecting the pistons to cranks or bends in the axle of the driving wheel. Now, when the wheel is driven at the rate of 250 revolutions a minute, with a train weighing 200 tons behind it, the strain on these said cranks is enormous. Not a week passes but two or three somewhere give way under it, and, though ninety-nine out of every hundred failures are, no doubt, detected in the shops, the hundredth flaw may only reveal its existence by a sudden smash, as the engine is careering at full speed down some bank like that at Penistone, with a heavily-loaded train behind it. Needless to say, mere considerations of prudence, to say nothing of humanity, will lead a railway company to reckon no expense too great and no solicitude too anxious to secure the perfection both of material and manufacture.

The material used was always, till lately, wrought iron; but, as steel manufacture becomes more and more scientific, and makers learn how to obtain the undoubtedly greater strength of steel without brittleness and without sacrificing the toughness and uniformity of the best wrought iron, no doubt steel, which has already begun to be employed, will come into more and more general use. To see the earlier stages of the manufacture, it is necessary to go to the works of one of the great Yorkshire or Newcastle firms. The writer watched it one day in the immense establishment of Messrs. Vickers at Sheffield. What the axle looks like when it comes to Derby may be best seen by a glance at the accompanying illustration. The two oblong masses of iron, some 15 inches long by 10 inches broad and 9 inches thick, looking like the wards of some gigantic key, are to form the "throws," as they are termed, to which are to be fastened the "big ends" of the connecting rods.

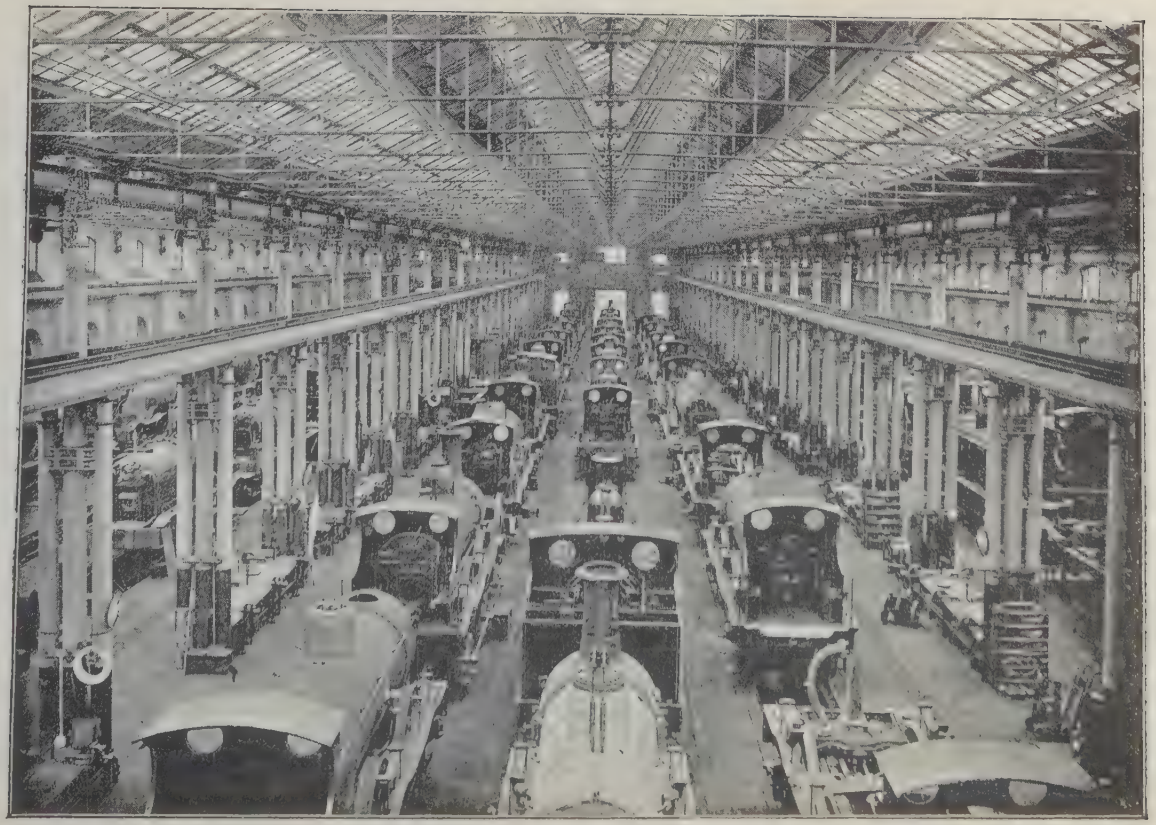
The first thing done after the axle goes to Derby is to cut out of the heart of each of the wards a slice wide enough to allow the "big end" to pass through. Of the slices one bit goes into the laboratory, to be subjected to chemical analysis to settle the composition of the metal—the amount of carbon, phosphorus, or what not, that it may contain. Another bit goes into the mechanical testing room, of which more anon. Supposing the results in either case unfavourable, the axle is rejected, otherwise it is passed for service. It is then put into a lathe, and turned down, so that from one wheel to the other it may be precisely of the same weight and thickness throughout, care being specially taken to avoid sharp corners and abrupt turns. In the finished axle in the picture two additional precautions that are taken at Derby may be seen illustrated. An iron hoop an inch and a half thick has been shrunk on round each of the four "webs" or cheeks of the "throws," and bolts have been driven through the "pins," or portions of the crank to which the connecting rods are fastened. So it is to be hoped that, even if a fracture should occur, at least the engine may be able to get home in safety. Then, when the "journals" or parts that run in the axle-boxes have been "trued up" with the utmost possible nicety, that the inevitable friction may be at least reduced to a minimum, the axle at length receives its wheels, and it only remains to fasten to it between the two "throws" the eccentrics, four in number—two for forward and two for backward gear—which work the slide valves to admit and release the steam in the cylinders.

In all the shops there is perhaps no more interesting point than the room, to which allusion has just been made, in which mechanical tests of material are performed. A new consignment, let us say, not merely of crank-axles, but of wheel-tires, boiler-plates, or what not, has been received. Portions are cut off (and in making comparisons care must be exercised that the sample of each class of article is taken from the same place), and then they are bent to test whether they are mild or highly tempered; they are crushed beneath

the tremendous pressure of a hydraulic ram; they are torn asunder, both to test their tensile strength, and also that the appearance of the fracture may be minutely studied. Specimens, numbered and dated, and labelled with the maker's name, contorted some of them into the most fantastic shapes, are ranged in glass cases all round the room. The makers' names are few, and for the most part world-famous. Too much may hang on the strength of a boiler-plate or a driving-axle for a company to be tempted to employ any but firms with an established reputation for first-class work. But one could see from the show cases that there is no best firm. One year A. may take the lead in one thing and B. in another, and the next year C. may be beyond them in both. A uniform standard of excellence is valued more than an average which is higher, but obtained as the mean of wider variations.

Nor are steel and iron the only materials that are tested here. A series of experiments has been conducted to settle whether English or foreign oak is the best for "keys." The conclusion goes to show that our præ-scientific ancestors, who took the oak as a type of the nation, had a true instinct after all. "English oak," ran the report, "the best on the whole, and will bear most punishing; foreign oak the kindest and the straightest grain." Lest our national pride should be exalted over-much, it must be added that the breaking strain in tons per square inch of surface was for the foreign wood 7·08, and for English 7·25, hardly a victory as decisive as our grandfathers would have thought their due. Steel under the same conditions will give out anywhere between twenty-five tons and fifty. Portland cement, as I learnt from some interesting experiments at the new St. Pancras goods station, will stand a strain of about 325 pounds to the square inch.

In the erecting shop, in which the engines are fitted together, there was one locomotive whose body appeared as though it were entirely swathed in cotton-wool. We often hear of boilers getting burnt, but it was difficult to suppose



HOSPITAL WARD AT DERBY

that their burns were treated with so human a remedy. So I inquired, and learnt that my cotton-wool was a substance known as silicate cotton; that it was manufactured out of the refuse slag of the furnaces; and that, being both a very bad conductor of heat and entirely incombustible, it was used for the "lagging" or covering of the boilers instead of wood, which is liable to take fire if overheated.

Not far from the engine shops are the carriage works, which are probably as complete and as well fitted with labour-saving appliances as any in England. At the entrance of the works the timber is delivered in huge balks and stacked. When it has been properly seasoned and is required for use, it passes into the saw-mills, thence forward into the planing shop, and so on, growing lighter and lighter at each stage as it advances on its journey, and only at length retracing its course when it is turned out in the form of a finished carriage at the further end. One most ingenious machine I watched for some time:—Two circular saws set obliquely on the same spindle, which pushed a board along in front of their teeth, and cut out dovetails on its edge as it passed. The whole of the belting for driving the different machines is in a cellar underground, so that the light falls unobstructed from the roof, and there is nothing overhead to interfere with the free movement of the workmen and their free manipulation of the planks or beams on which they may be engaged. A more ghostly place than that same underground cellar, with an endless vista of belts and pulleys and driving gear, humming and whizzing in the dim light—made yet more dim by the floating particles of sawdust with which the air was full—it has seldom been my lot to visit.

In an adjoining room over a hundred women are busily at work on the interior fittings of the carriages. Some are making and stuffing cushions—I sometimes think if they were less lavish of horsehair it would both be more comfortable for the passengers and more economical for the Company—others are sewing curtains and blinds, and a

large number are occupied in french-polishing the sycamore panelling and the mahogany window-frames.

Not far off is the ticket-printing establishment. Ten or twelve years back Mr. Williams calculated the acreage of the tickets used on the railways of Great Britain in the course of a twelvemonth. At the present time I count that the Midland acreage is (at 2,000,000 to the acre) about seventeen. The tickets come in boxes, 50,000 in a box, from Paisley, where they are made. The bulk of them are in four plain colours, first and third class, up and down respectively. But there are not a few—special excursion tickets these—with particoloured stripes and hoops. Here is a set of four, return tickets to Epsom for Derby Day, one pair available by the South Western, the other pair by the Brighton line; for indeed ticket-collectors need not only all their wits, but all the help that conspicuous markings can give them, if they are not to be bested by certain members of the racing fraternity. A few years back it might have been difficult, without the aid of illustrations, to describe the printing machine to those who have not seen one. But the difficulty fortunately exists no longer. Imagine an automatic sweetmeat machine, that once it was set going went on gladdening the heart of youth with cakes of butter-scotch till there were no more left to give, and you have a very fair idea of what the thing is like. The ticket-machine, however, has one accessory that its younger rivals by all accounts sadly lack—a bell, which rings to call an attendant the moment anything goes wrong, if a ticket is not exactly opposite the centre of the die, or if its corner is dog-eared.

In the Dark Ages of railway history, tickets were numbered in consecutive order, so that, if there was not room in the train for everybody, persons might "have priority according to the order in which the tickets have been issued as denoted by the consecutive numbers stamped upon them." If this were the only use for the numbering, it might be abandoned nowadays. But it serves a much more important purpose than this – as a security against fraud. Supposing tickets

stolen without the numbers on them, they would be refused at once by the collectors; with the numbers, they would be stopped, like bank-notes, by a telegram from the printing-office. Tickets forged elsewhere, whatever numbers were impressed upon them, would be detected immediately they reached the audit department, and the forgers might easily be caught without their knowing that they were even watched. Further, when tickets are required at out stations, it is the business of the station master to send in a written requisition for them, and the numbers as issued to him form a record of the tickets for which, or else for their money value, he will be required to account later on.

A not unimportant official at Derby is the Company's photographer in ordinary. His functions are various. When engines or carriages of a new pattern are constructed, he takes a record of their features. Again, perhaps it is reported to the engineer that a viaduct shows signs of giving way, that a wall has cracked, or an embankment slipped, and in the first instance, if the damage is only slight, instead of going himself to see the state of affairs, he sends the photographer to see and record it for him. Or, if an accident has happened, there can be no dispute afterwards how the engine was lying, or whether such-and-such a carriage left the metals, once a commission has been issued to take the evidence of the sun. A few miles off, however, at Trent, is established a yet more remarkable portion of the Company's staff: eight cats who are borne on the strength of the establishment, and for whom a sufficient allowance of milk and cat's-meat is duly provided. And when we say that the cats have under their charge, according to the season of the year, from one to three or four hundred thousand empty corn-sacks, it will be admitted that the Company cannot have many servants who better earn their wages. The holes in the sacks, which are eaten by the rats, which are not eaten by the cats, are darned by twelve women, who are employed by the Company.

"But what on earth does a railway company," the reader

may not unnaturally ask, "want with 450,000 corn-sacks at all?" The explanation is that the Company has to furnish the sacks in which the corn is conveyed over its line from the farmer to the miller. Formerly this was a separate business in the hands of an independent contractor, but of late years most of the great companies have found it more convenient to abolish one of what the expressive Yankee phrase calls the "side shows" on the line, and to take the matter into their own hands.

Adjoining the sack-store, which is surely a development of railway working that even the prescient genius of a Stephenson could hardly have foreseen, is the sheet-store, where a hundred men are constantly employed making and repairing the tarpaulins ("sheets" they are always called, with which the railway trucks are covered. Some ten thousand are turned out new every year; and nine times that number come back annually to be repaired and redressed, though there are repairing establishments at Birmingham, Leeds, and St. Pancras as well. For the usage to which they are exposed is of the roughest, and the hole that lets the water in, on to perhaps a case of drapery or a bale of silk, may result in a claim of £100 as damages. The manager of the stores has recently designed an ingenious folding trestle which runs from end to end of the truck, and acts like a ridge-pole to form a sloping roof, and so prevent the water from lodging.

Anyone accustomed to foreign or American railway practice will perhaps wonder how silks and draperies come to be in open trucks at all. No tourist can have failed to notice that in France and Germany a goods train is almost entirely composed of covered or "box" wagons. That they keep out wet is undeniable, but for all that they are most unpopular in England, from the fact that they take so much longer in loading and unloading. Take the case, for example, of hops from London to Burton. A truck-load of hops may be valued perhaps at £200 or £300, and if it gets wet it is worthless. But still the Burton brewers would grumble if

their hops were sent down to them in covered wagons. At present they draw the truck alongside their hop-store, under a projecting roof of corrugated iron which they call an "apron," and then have only to throw off the tarpaulins and hoist the pockets into the store as fast as ever the crane can take hold of them. But goods as valuable as silks and hops are, it should be said, as a rule "double sheeted."

Apart from the odour, which to one who is unaccustomed to it is at least unpleasantly powerful, the process of manufacturing sheets is interesting from its colossal scale. Widths of jute sacking are stitched together by machines that bear about the same proportion to the sewing-machine of domestic use that a warming-pan bears to a watch. The mixture with which they are dressed is composed of boiled oil and vegetable black, oil in vats and lamp-black in casks. For the dressing they are laid out on the floor and painted over with huge brooms. Each sheet first receives five coats of black, next a broad edging of yellow, and lastly its number and the letters M. R. are stencilled upon it. It is then hung up to dry for six weeks or two months, when it is ready for use. The number enables its life history to be traced in the store books, but with the help of the yellow edge it serves the further purpose of identification.* Every day, at scores of junctions all over Great Britain, Midland sheets by the hundred are passing over on to "foreign" lines. A record of each is kept and sent next morning to the Clearing House in London. If within a few days the Clearing House does not receive word that this same sheet has been returned, a charge for demurrage is made against the foreign Company.

Something must be said later on with reference to the much-vexed question of brakes. Whether a brake should be "vacuum" or "pressure," automatic or simple, is still matter

* North Western sheets are marked with two red lines, those belonging to the Great Northern with white and blue lines running crosswise from corner to corner, &c., &c.

of controversy.* But all are nowadays agreed that a continuous brake of some kind is absolutely indispensable, and there is hardly a passenger carriage on any of the great lines to which such brakes are not already fitted. The Midland was the first company to introduce into England the "Westinghouse," a form of brake that is now universally adopted on more than one of the leading English lines, and throughout almost the whole of Scotland. Nor was this the only important improvement the Midland imported from across the Atlantic. The Pullman drawing-room cars, though they run all over the country from Brighton to Perth, can hardly be said to have had more than a *succès d'estime*. But in their more recent development of breakfast cars, and luncheon cars, and dining cars, they are as yet only in their infancy, and evidently have a great future before them. The Pullman "sleepers" have not only given many a hard-worked man of business a good night's rest, but have also stimulated other railways, that have not cared to adopt the American design pure and simple, to furnish sleeping saloons divided into the separate compartments that are so dear to the heart of every true Englishman.

All honour to the Midland for their plucky attempt to benefit not only their own shareholders but the public at large by the introduction of carriages built on the American system. They have, as has been already said, produced a considerable direct and a still greater indirect effect. But they have not revolutionised English carriage construction; nor are they likely to do so, for the simple

* [The controversy has now long been closed, and the matter decided, in spite of the protests of not a few of the leading railway experts. Since the passing of the Railway Regulation Act, 1889, automatic brakes have been required by law to be provided on all passenger trains. It is questionable whether a single person could be found to-day to deny that the experts were wrong and the public right. The controversy just opening at the time of writing is whether continuous automatic brakes shall not also be fitted to English goods trains, as they are already to the goods trains in America, Australia, and even Russia. -1899.]

reason that the British public—it may be of course from sheer stupidity—as a rule deliberately prefer to be "boxed up." It is not a little amusing, after Pullman cars have been running in England for a dozen years, to read in a leading article a statement like the following: "As in America, rich, weakly, nervous, luxurious, or studious people will, if they can pay for them, demand selected railway carriages, and hence the system of running Pullman drawing-room and sleeping-carriages on all trains will soon come into fashion." * Did the writer never reflect that there were general managers and superintendents by the dozen, whose main business it is to study the wishes of their customers, and that they would all have put on Pullman cars fast enough, if they had only seen reason to suppose that the rich, the weakly, the nervous, &c., &c., would pay first-class fare for the privilege of riding in them? One ingenuous American correspondent of the *Times* declares that he "can thoroughly understand why slow-going methods have to be still adhered to in old England . . . for she cannot sell her antiquated rolling stock to some new 'backwoods' road beyond the Rocky Mountains." Unless this gentleman is under the impression that Derby, and Wolverton, and Swindon and the rest of them have only turned out some fifty new carriages since 1875—there cannot, I think, be more than this number of Pullmans in the country—the explanation seems hardly adequate.

The truth is—and, however difficult it may be for Americans to believe the fact, it is undoubtedly the truth—that we maintain in England our "lonesome stuffy compartments," simply because we like them. For my own part I can honestly say, after a good deal of experience of both kinds of locomotion, that I would rather be "boxed up" in a Midland third-class than have "the privilege of enjoying the conversation of the general public" in the most luxurious car that Pullman ever fashioned. I would go further, and

* *Observer*, Sept. 2. 1888.

say that, strange as it may seem to gentlemen who are so delicately nurtured, that it makes them uncomfortable to hear that other people are deprived of access to a lavatory for three whole hours, to me the loss of this inestimable boon would be cheaply purchased by the certainty that for three whole hours one is "safely locked in and protected from the babies who squall, and the babies of a larger growth who whistle and drum upon the window panes."

But the introduction of Pullmans meant something more than the introduction of American open cars. It meant the introduction of carriages running upon bogie trucks. And that to passengers has been almost pure gain. Now that bogie carriages have been adopted on almost every line in the country, it behoves us to remember that we owe their smooth and easy motion to the enterprise of the Midland. But the gain is not quite unadulterated A bogie carriage—even if it be not like a carriage which an ingenious citizen of Chicago is said to have patented, 100 yards in length—weighs perhaps on the average 20 tons and seats 50 people ; and five of them make up a very fair-sized train. Bogies and through carriages from everywhere to everywhere are therefore in practice mutually exclusive terms. And if there is one thing the British public appreciate more than another it is through carriages.

[The last ten years have seen great changes in this matter of drawing-room or open non-compartment carriages. The Midland, which originally introduced them, have practically abandoned them. But in the South of England Pullmans are well established on the Brighton, Eastbourne, and Bournemouth expresses. The South Eastern Company has gone further, and runs to Hastings and Folkestone trains of open cars on the American system for all classes of passengers. On a good many routes, for instance, the East Coast, the West Highland, the Great Western, the South Western in the case of the "boat specials" to and from Southampton, and the new through route of the Great Central—formerly Manchester, Sheffield and Lincolnshire—to London, carriages

are run in which two or sometimes three compartments are thrown into one. But no carriage that I have yet seen is open from end to end, having all the seats with low backs, and facing the same way, like the ordinary American "day coach." The form of construction which on the whole seems to be finding, however, most favour with the English public for long-distance journeys is the "corridor carriage" or "corridor train." Both East Coast and West Coast companies have adopted this pattern, in which all the compartments open on to a corridor down one side of the carriage, for their day Scotch expresses, all the new Great Central stock is so constructed, and so are the principal express trains on the Great Western Railway. But if anyone will walk along a corridor train to which carriages of the ordinary type are also attached, he will easily satisfy himself that the number of insular Britons who deliberately prefer to be "boxed up" is still far from inconsiderable. 1899.]

While we are on the subject of bogies, it is worth notice that within the last few months there have been on show, appropriately enough in the new Midland goods yard adjoining St. Pancras, some bogie "freight cars," or goods trucks of American build. These cars are 34 feet long, or, roughly speaking, double the length of an ordinary English goods truck. They weigh 10 tons and carry a load of 30 tons. To move the same weight an English company would use at least five, probably six, trucks weighing when empty 5 tons apiece. In other words, in order to earn the freight on 30 tons of produce, an English company would need to haul a gross load of 50 or 55 tons, its American rival would only need to haul 40. Further, the goods would only need a length of 34 feet of siding accommodation, at present they require treble this allowance. When we add to this that simultaneously with, and largely in consequence of, the introduction of these large freight cars, the Americans have been able to reduce their goods rates that a few years back were quite as high as English ones—which probably may be averaged at something like five farthings per ton per mile—

to only a fraction over a halfpenny,* we have evidently accumulated abundant material for the composition of an article, demonstrating with overwhelming cogency the purblind conservatism of English railway management.

Perhaps, however, before the culprits are hurried away to execution, it might be well to ask whether they have anything to plead in arrest of judgment. Interrogate a goods manager, and what he will answer will probably be much as follows:—"It is quite true, as you say, that our trucks weigh much heavier in proportion to their load than those in use in America, but the fault I have most often to find with them is not that they are too small, but that they are too large. They will carry, you say, 7 tons: I should think myself very lucky if they took, as a rule, the half of that weight; often, and especially in the slack time of the year, or when trade is depressed, they don't carry the quarter. You see our trade and that of America are totally different. American lines carry corn from the North West, beef and bacon from Chicago, cotton from the Mississippi valley, and so forth in hundreds of train-loads and tens of thousands of tons, half across a vast continent, down to the great towns upon the Atlantic seaboard. Thirty-ton trucks are in their right place there, but what should I do with them to carry a couple of tons, say, from Bradford to Southampton? If our English customers would be satisfied with goods trains run at the American speed of 12 or 15 miles an hour, it would be a different matter; we then might possibly load goods for different places in the same truck, and stop to unload and fill up again *en route*. But that won't do for English people; if the goods were not alongside the wharf in Southampton next morning, the Bradford manufacturer would soon transfer his custom to one of our competitors.

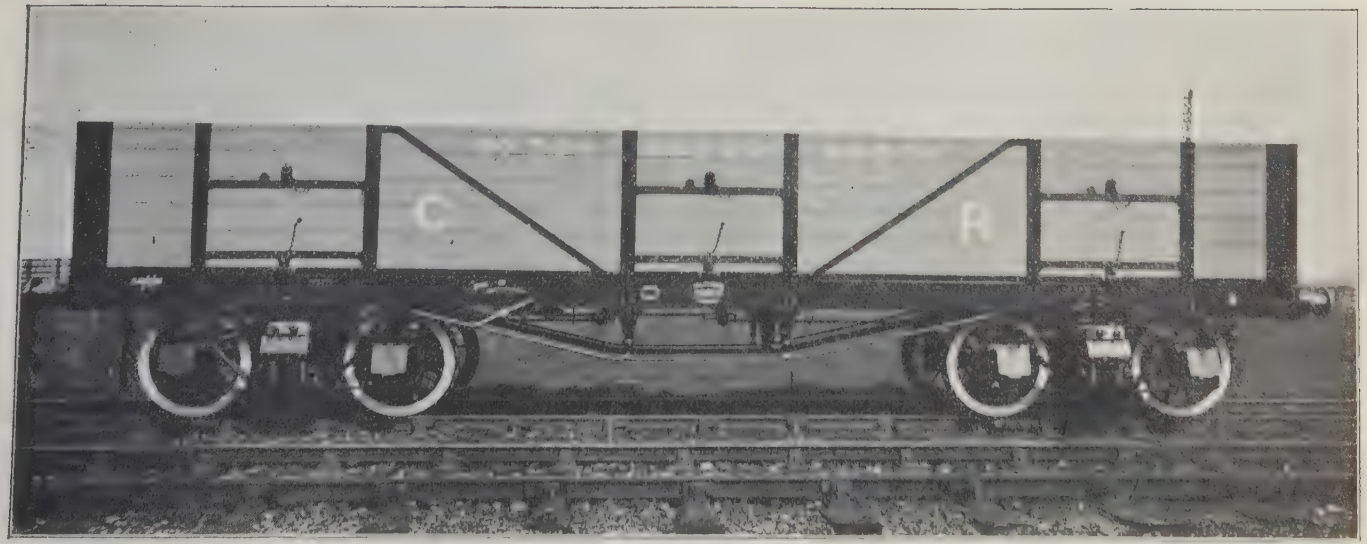
"The American manufacturers talk of their cars as being built with 'steel tubular framing.' Our engineer is rude enough to describe it as 'gas-piping,' and to declare that

* [Now a good deal under. 1899.]

the whole build of the vehicles is much too flimsy for us to risk having it knocking about on our road in the midst of all our fast passenger expresses. Besides, what would the Board of Trade say to their cast-iron wheels? I believe, if you were to build these cars strong enough to come up to the English standards, they would weigh more like 15 tons than 10, and then where's all your economy gone to?"

Such would be, I believe, the substance of the answer that an English railway manager would make. However, it is understood that some of these bogie cars have been ordered on trial by the enterprising management of the Furness line; so there will be an opportunity, before long, of putting American methods to the practical test of English experience. Let us hope, in return, that Mr. Webb's new compound will show the engineers of the Pennsylvania Railroad that even in England we can build locomotives.* Certainly it is high time the railway men of the two countries should get to understand, and appreciate one another better. Hitherto there has not been in the whole universe a more useless and misshapen creation than an English locomotive as described by an American — unless, indeed, it be an American locomotive as described by an Englishman. We

* [Mr. Webb's compound satisfied the engineers of the Pennsylvania that, though England could build excellent engines for English trains, they were too small to haul the massive American cars. As for bogie goods trucks the matter still remains much where it was ten years ago. The cars on the Furness have only, I believe, been used between the steel works and the dock sidings in Barrow itself. But the Caledonian has just begun to build 50-ton trucks for coal and iron-ore traffic, so an adequate trial will really be made before long. But the "tubular-frame" method of construction has failed to prove its alleged superiority, and these new cars, as will be seen from the illustration on the next page, are carried on steel beams of ordinary girder shape. They are also, it is interesting to notice, fitted with Westinghouse brakes, the first goods stock in this country to be so supplied. As Mr McIntosh, the very enterprising locomotive superintendent of the Caledonian, to whom we are already indebted for the most successful new type of express engines (the "Dunalastairs") which has been introduced on British railways for a long while past, is understood to be personally a believer in big wagons, we may now hope to see this cardinal feature of American "operation" fairly tested in this country under favourable circumstances. 1899.]



FIFTY-TON IRON ORE WAGON.

shall see directly what "our" Mr. Cook thinks of American passenger cars. Here is the other side of the shield as seen by an American engineer, Mr. Dorsey. Of our English third-class, he writes:*—"On the carriages for third-class travel no attempt at ornament, finish, or comfort is ever made, they being generally little better than our box cars (*i.e.* goods trucks) with cheap seats and cushions."

There is another thing the Midland has done for us besides improving our carriage accommodation. Englishmen could always claim that their railway service was the fastest and most convenient in the world. If to-day we can boldly claim that the passenger service is also the cheapest, that we owe to the enterprise—some few railway men would still say to the mistaken generosity—of the Midland. People talk of high fares, and in Kent and Sussex first and second-class fares are high enough in all conscience. They forget, however, that for one passenger first-class to Hastings there are a thousand who book third to Manchester and Liverpool, while even in Kent and Sussex the third-class fares are only one penny per mile. From Paris to Havre the distance is 142½ miles. There are five third-class trains in the twenty-four hours, but not one of them between noon and 11 at night; the best third-class train takes six hours all but five minutes, the average is 7·21. From London to Sheffield, fully twenty miles farther, there are seventeen third-class trains, of which none take more than four hours, while one performs its journey under three hours and a quarter. The French fare is 12*s.* 4*d.*; for the additional twenty miles the English companies add on an extra ninepence. And not only are English third-class carriages incomparably better than their foreign rivals, but (apart from the Brighton, South Eastern, and Chatham lines, which are corrupted, doubtless, by the evil communications of the Continent) there are only six trains in all England

* 'English and American Railways Compared,' p. 50.

from which third-class passengers are excluded.* [There is not one now. 1899.] It would be well if the French companies would offer evidence of as practical a belief in the great doctrine of equality.

When I made the statement some months back that the English railway service was the cheapest in the world, I was rash enough to think that its truth would ensure it against contradiction. But I was mistaken: an American gentleman is able to state categorically in the columns of the *Times*, speaking apparently from personal knowledge of the exact fares and distances over 150,000 miles of line, that the United States fare is precisely 1*d.* per mile. Relying on statistics—now, I admit, some years old—I had taken the average at $1\frac{1}{4}d.$ as against $1\frac{1}{6}d.$, the accepted average for all classes here. My error appears to be shared by a not undistinguished traveller, Mr. John M. Cook of Cook's Tourist renown, who writes, "The rates of a very large mileage of railways in America fluctuate from 2*c.* to 5*c.*, 6*c.*, or 7*c.* per mile; many of the fares, especially on the southern lines, average about 5*c.*" To the same effect is the evidence of Professor Hadley, of Yale College. In his brilliant book on 'Railroad Transportation'† he writes: "In general, it may be said that passenger rates are lower in England than in the States. There is but slight error in regarding two cents per mile as the normal passenger rate in England, while that in America is nearly 2·35 cents per mile, although the average American passenger journey is three or four times as long as in England." It is possible, however, that Mr. Cook's figures and Professor Hadley's conclusions are also out of date. So let us take the latest official returns. According

* The list is given in full on p. 374. It has been suggested to me that it is unjust to condemn the South Eastern and the Chatham for excluding third-class passengers from most of their Continental trains, as "it would be useless to do so, as long as the foreign railways refuse to admit them to the expresses on the other side." The argument is not without weight, but neither company has hitherto shown much sign of impatience of the *force majeure* by which it is restrained.

† Putnam's Sons, New York, 1886, p. 157.

to Poor's 'Manual of the Railways in the United States for 1888,' last year there were carried on the railways of that country 428,225,513 passengers, each of whom travelled an average distance of 24·68 miles, paying for such service an average fare of 2·276*c.* per mile. Add to this the charge for the drawing-room and sleeping cars belonging to the Pullman, Monarch, Mann, and other companies, which, as they are not received by the railway companies, are not included in the above figures and cannot be exactly given, and we can hardly arrive at a total charge lower than that which I have given above.

But let us assume the absolute accuracy of the American gentleman's recollections. The state of the case would then be that the American ordinary car costs 1*d.* per mile, the English ordinary car—the third-class carriage—·95, or 5 per cent. less. It would have to be admitted that the English *voitures de luxe*—first and second-class carriages—were charged at a higher excess rate than the American Pullmans. But the main question, the only interesting question to eleven passengers out of every twelve, would be, how do the two companies compare in the matter of their ordinary car accommodation? Let us appeal once more to Mr. Cook. He writes: "I am bound to say, from my experience over many thousands of miles in the States, that the ordinary car . . . is not nearly as comfortable, even for a long distance, as the improved third-class carriages of the Midland and other leading lines in England. The only advantage they have over the English third-class carriage is the facility for moving about and the lavatory arrangements; but to set against these they have, as a rule, hard, uncomfortable seats, which only come to the middle of the back, without any arrangements for head rests or comfort for a long journey; the passengers have to provide these themselves, and I say that I would rather travel from London to Edinburgh or Glasgow in an ordinary third-class carriage than I would travel on any

railway I have been on in America in their ordinary cars."*

If the English claim is to be successfully challenged, assuredly Belgium, and not the States, should be the challenger. Undoubtedly the Belgian fares by ordinary train are lower than the English. For 50 miles by express trains on the State lines—on the private lines they are somewhat higher—they may be given at 6*s.*, 4*s.* 6*d.*, and 3*s.*, for the three classes respectively. But then we must add to this the charge for baggage, that in England goes free, which, taking the English allowance of 120, 100, and 60 lbs., would in round figures bring the fares up to 8*s.* 3*d.* first, 6*s.* 2*d.* second, and 4*s.* 4*d.* third. To Bedford, 49¾ miles from London, the fares are 6*s.* 7*d.*, [5*s.* 3½*d.*]† and 3*s.* 11½*d.* Further, it must be remembered that only 59 per cent. of the Belgian expresses carry third-class passengers at all, while only what Mr. Herbert Spencer calls the "bias of anti-patriotism" pushed to the verge of unreason could lead anyone to assert that the third-class accommodation (where it does exist) is equal to that provided for English passengers. Let me add, too, that I am quite aware that the Indian railways convey passengers for about a farthing a mile. But the analogue of this is not the price charged for a seat in the 'Flying Scot' or the Manchester Express, but the rate for the conveyance of sheep "in full wagon-loads." The fastest Indian train now runs at the rate of 23½ miles an hour, but of course third-class passengers are not carried at this break-neck speed.‡

* This summer (1889) the Midland has once more led the way in adding to third-class comfort. It has put third-class lavatories in all its principal expresses, and by so doing has challenged one of the chief American claims to superiority. One is glad to learn that at the same time by its action in this particular it has been much aided in the fierce conflict against the North Western for the Bristol traffic. But, of course, the other companies will follow suit. Indeed, on the 10 o'clock 'Scot,' the East Coast companies have already done so.

† Second-class by L. & N. W. R. only, not by Midland.

‡ [I leave this as it was written ten years ago. In the Supplementary Chapter I have attempted to show in outline the comparative effect of the changes that have occurred in recent years. 1899.]

It is well to bear in mind that the innovations introduced by the Midland Company are divided into two very distinct categories. It has both abased those that exalted themselves, and exalted them of low degree. It was in 1872 that third-class carriages were attached to all trains, and not till 1875 that the second-class was abolished and the first-class fare reduced to second-class level. Dealing with the latter point first, it may be that the change was a mistake. Certainly the fact that none of the great English companies have hitherto followed the example unreservedly is a strong argument against it; for whatever the people who write letters to newspapers on the subject may think, railway managers really do study these questions with care, and, what is more, they have at their disposal, in order to guide them to a right decision, vast stores of statistical information that are not accessible to the public at large. It may be—for my own part I offer no opinion, an opinion based on insufficient data cannot but be valueless—that the wiser policy would have been to leave the first-class fares unaltered and to retain the second-class as a more select third at fares only slightly higher, or say about five farthings per mile. One of the leading railways would, I have the best reason to know, like to try this experiment at the present moment, and is only deterred from so doing by the protests of a yet more powerful neighbour.*

As for the admission of third-class passengers to all trains, there can, I conceive, be no doubt that the event has abundantly justified the wisdom of the policy. Not only have competing lines like the North Western and the Great Northern followed suit; not only have companies like the North Eastern and the Great Eastern, which have their districts to themselves, done likewise; but the South Western, situated though it is between the Great Western and the Brighton, which still adhere to some extent to the exclusive theories of a bygone generation, has copied the Midland unreservedly.

* [See Supplementary Chapter. 1899.]

Nor can the significance of the published figures well be doubted. In 1870 the first-class passengers numbered 27,000,000, and their fares amounted to £3,300,000. Last year, it is true that their numbers had decreased to 25,000,000, and the receipts from them to £2,500,000. But, in the interval, the third-class passengers had increased from 200,000,000 paying £6,000,000 to 560,000,000 paying nearly £16,000,000. For the last half-dozen years the goods traffic has been practically stationary. In the same period, spite of hard times and bad trade, a generation that has grown up accustomed to fast and cheap travelling has added an average of about £1,000,000 each year to passenger earnings. Admitting, however, for the sake of argument, that Sir James Allport, in urging his proposals upon the Midland Board, mistook the interest of his shareholders, there can be no denying that upon the population of the country at large he conferred a boon that entitles him to rank with Rowland Hill as a benefactor of his species.

CHAPTER V.

THE GREAT NORTHERN, THE NORTH EASTERN, AND THE MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE [GREAT CENTRAL] RAILWAYS.*

"The Great Northern Railway ends," so the first Chairman of the Company, Mr. Denison, the father of the present Lord Grimthorpe, informed an indignantly interrogative shareholder at a half-yearly meeting some forty years back —"the Great Northern Railway ends in a ploughed field four miles north of Doncaster."† And there its terminus has remained unto this day; but, of all the millions of passengers who travel over the line, it may be questioned whether one in a hundred thousand ever so much as heard of Shaftholme Junction.

The fact, for all that, may be regarded as typical. None of our great railways is so closely involved with its neighbours as the Great Northern. Of the main-line trains that leave King's Cross there is hardly one that performs its journey throughout under Great Northern control. To get to Cambridge, they pass on to the Great Eastern. To reach Sheffield and Manchester, the Company needs the alliance of

* Let me repeat here, what has already been said in the preface, that this book has no claim to be considered as a complete and symmetrical account of English railways. It is calculated throughout, if I may so say, for the latitude of London. It is necessary to insist on this point, as otherwise the dismissal of the North Eastern and the Sheffield in a few pages, and the still more casual mention of the Lancashire and Yorkshire, would be rightly looked upon as an inexcusable lack of the sense of due proportion.

† This story was told me by my old friend, Mr. Henry Carr, one of the most distinguished of the pupils of the late Sir William Cubitt, and engineer, under his "master," not only of a considerable portion of the Great Northern Railway, but also of Blackfriars Bridge.

the Manchester, Sheffield, and Lincolnshire ;* a stage further to Liverpool, over the "Cheshire Lines," calls in the partnership of the Midland as well. The road to Leeds, where the station stands on ground owned by no less than four companies, is over a line which is the joint property of the Great Northern and the Sheffield Company. We might point our moral by a comparison between the Great Northern and North Western. The main line out of Euston is reserved for North Western trains alone; but South Eastern, and Chatham and Dover, and North London rolling stock will all be met with outside King's Cross. What Crewe is on the one line, a great manufacturing centre as well as a great junction, that Doncaster is on the other. But, while Crewe accommodates North Western traffic almost exclusively,† no less than six "foreign" companies run their trains into Doncaster. And yet, whether it be that the Great Northern management is too busy accelerating its expresses and improving its services to have time to quarrel, or that all its pugnacity was used up in the earlier years of its history, nowadays all the complicated arrangements, and agreements, and treaties for joint user, and running powers, and through services, work with such perfect harmony, that in nine cases out of ten the outside public is all unaware of their existence.

For indeed, during the first quarter of a century of its history, the Great Northern was pre-eminently a fighting line. At its birth in 1845, when "King" Hudson fought with (in Lord Brougham's phrase) "twelve-counsel power" before a Committee that sat six days a week for the best part of two Sessions, there raged a storm whereof Parliamentary Committee rooms have since scarce seen the like, and no less

* [The alliance being dissolved, and the Sheffield Company having been renamed, the phrase should now be "needs to exercise its statutory powers over the Great Central." 1899.]

† "What 'foreign' companies' carriages, if any, run into Crewe Station?" is a question that should only be set to candidates for "honours" in an examination for the degree of M.B.—Master of "Bradshaw."

a person than Charles Austin was peremptorily refused a hearing. From the chair at the Midland Company's meeting Hudson told his shareholders that there only needed to be added to the Great Northern scheme "the humbug of the atmospheric principle, to make it the most complete thing ever brought before the public." He added, moreover, that he would undertake to leave London with twenty carriages by the London and Birmingham and Midland Railways, and beat his rivals to York, "and, more than that, he questioned whether in foggy weather they would ever get there at all." Whether the race proposed by the Midland Chairman was ever run, history does not relate; but, if a train from Euston ever reached York—I will not say in less than the 3 hours and 22 minutes in which the distance was covered on two occasions, but in less than the 3 hours and a half which was the time allowed for the 10 o'clock express from King's Cross during the larger part of the month of August, 1888—"Bradshaw" certainly contains no record of the fact.

This, however, though the first Great Northern battle, was a long way from being the last. In the year of the Great Exhibition there was a furious conflict, and the third-class return fare from Leeds to London came down to 5*s*. The following year an attempt was made to amalgamate with the Midland, but Parliament refused its consent. Four years later the strife broke out afresh, and in 1856 a man could book from York to London and back for 5*s*. first class, and 2*s*. 6*d*. third. The intermediate stations also took part in the scrimmage, and the Peterborough fares were 2*s*. and 1*s*. respectively. The Exhibition year (1862) saw another pitched battle, but this time the Midland were only lookers-on; and the fight was between the Great Northern, which was competing, *viâ* the Sheffield line, for the Manchester traffic, and the North Western. The Lancashire folks were taken to London to see the Exhibition and brought back again for the modest sum of half-a-crown, and, what is more, as long as summer lasted, and the trains were full, the companies lost nothing by the transaction. Then in 1871 it was

the Midland's turn again, and war raged for months, during which both companies carried coal from South Yorkshire to London at about one-third of the normal charge.

It is amusing how the reputation of a company may change in the course of a few years. To the present generation the Great Northern is an eminently staid and respectable concern, and the escapades of its harum-scarum youth are long forgotten. But let us listen to Mr. Williams. The time is the end of 1871, and the occasion the proposed intrusion of the Great Northern into the Derbyshire coalfields, which was one of the results of the rate war of the previous summer. "From the first hour of its existence the Great Northern had lived and thriven as a vast parasite, drawing its daily life from the trunk and branches of what had been the Midland system. Now it was about if possible to fasten itself upon and to draw the traffic blood from the heart of that system." A few years later, when the Midland Company had clasped with its tendrils Bournemouth, Swansea, Carlisle, and King's Lynn, none of which could have been described as situated in the heart of its original system, not a few persons might have been found to apply somewhat similar language to the Midland itself. And now, to-day the Midland too has sown its wild oats and settled down to a humdrum domestic life like its neighbours; for of late years little has been heard of conflicts such as these. It is true that the southern lines quarrel among themselves, though their quarrels hitherto have shown no signs of leading to a reduction of fares and rates; but the great companies, though competition is as keen as ever, manage nowadays to live and work in harmony.

Railway public opinion, as focussed in the powerful though unreported Clearing House meetings, has laid its ban upon what is known as "unfair" competition, upon sweeping reduction of fares, and wholesale cutting of rates. A company may take away all its rival's passengers by providing faster and more frequent trains, better carriages and more convenient stations; or it may get hold of its neighbour's goods

traffic by offering greater regularity and speed of despatch and delivery. But it may not, for example, avail itself of an American form of competition (now forbidden by law there) and bribe a coal owner or a manufacturer to send his products over its line by giving free passes to himself and his family. Nor may it, where traffic is competitive, quote special rates below the accepted tariff without its rival's consent. In fact the competition must be open and above board, or the offending company will be sent to Coventry. As instances, we may mention that a short time since the conduct of a carter who fetched some hampers of fowls away from an agricultural show at 6 in the morning, when the different companies had agreed overnight not to begin to clear the yard till 7, was solemnly investigated and adjudicated upon at a meeting of officials of all the lines concerned. Again, the traffic superintendent of one of the great companies recently consulted his brethren at the Clearing House whether he should agree to the proposal of a London theatre manager and issue return tickets, including admission to the theatre, at a reduced rate.

Competition, however, still, as we know, exists, though its form may be changed, and as between the three great northern companies we may say with reasonable accuracy that, while the North Western has laid the chief stress upon comfort and frequency of service, the Great Northern has for years been unrivalled in speed; and the Midland, whose gradients forbid speeds which, on paper at least, can match the Great Northern, has striven to the utmost of its power to combine both attractions. And the speed on the Great Northern is simply phenomenal, not merely on the through trains to the great towns of the North, to Manchester and to Scotland, but to second-rate provincial towns, such as Lincoln and Cambridge. Take Cambridge for example, which is 58 miles from London, and on a branch line. The Great Northern supplies it with seven expresses each way daily, twelve of which vary between 77 and 85 minutes, while only two are as slow as 90.

Lincoln also is on a branch line 130 miles from London. It has nine down trains every day, the fastest accomplishing its journey in 2 hours 47 minutes, while the slowest only takes 3 hours 43 minutes. Three of these trains are timed well over 40 miles an hour. Two others are yet more remarkable. The 5.15 A.M. stops ten times *en route*, and runs at the rate of 39⅜; the 2 P.M. (Saturdays only) stops nine times, and is timed at the rate of 40 miles an hour throughout. And the Great Northern seldom fails to perform on the metals what it promises on paper. Birmingham, on a trunk line to the north of the Great Western—a company not usually supposed to run slow trains—is one mile nearer London. It not only has fifteen times the population of Lincoln, but it has great towns and important railway centres, such as Wolverhampton, Shrewsbury, Chester, and Birkenhead behind it. To Birmingham the Great Western has only two trains in the day at 40 miles an hour or over, only six as fast as the slowest of the Great Northern nine to Lincoln. The 4.45 P.M., which is the best of the two expresses, only beats the fastest of the Lincoln trains by five minutes; the other, the 9.55 A.M., a new express last summer, is 3 minutes worse. Even the North Western, whose road is 16 miles shorter, cannot get to Birmingham under 2 hours 40 minutes.

Not that the Great Northern would consider their services to Lincoln, or to Cambridge—though the best train each way between Cambridge and London is timed at over 45 miles an hour—a fair specimen of Great Northern speed. Their really fast services are three—the East Coast, the West Riding, and the Manchester expresses, and the fastness rises in the order given. The famous 'Flying Scotchman' goes to York (188 miles) in 3 hours 45 minutes, or at the rate of a fraction over 50 miles an hour, and is timed to pass Doncaster (156 miles) 3 hours 6 minutes after leaving King's Cross. But the 1.30 P.M. Leeds train draws up at the Doncaster platform in 3 hours 3 minutes, and the 9.45 A.M. takes only 1 minute longer. From Doncaster to Leeds is only 29½ miles; but

the gradients are heavy for a large part of the distance; the line is a network of junctions, and crossings, and sidings; and there are stops both at Wakefield and at Holbeck; so that to reach Leeds in 3 hours 50 minutes, as is done by the 9.45, is really a finer performance than to run along the flat valley of the Ouse to York, 2½ miles further, in 5 minutes less time.*

But to Leeds and to Edinburgh the Great Northern has its rivals well in hand, and has no great motive for further acceleration. To Manchester, however, it is another matter. From Euston to Manchester is only 189 miles (by the road some of the trains take through the Potteries it is 6 miles shorter still); from St. Pancras it is only 191¼; while from King's Cross it is no less than 203. Moreover, if the Midland route is somewhat harder, the North-Western is undoubtedly a great deal easier. For the Great Northern, therefore, to hold its own against the flying four-and-a-quarter hour expresses of its two rivals, means simply that it must run 3 miles an hour faster than what are almost, if not quite, the fastest series of trains in the world.

* In 1880, the Great Northern Railway ran two expresses each way daily between Leeds and London in 3¾ hours, and on one occasion they brought up the Duke of Edinburgh special in 3½ hours. The Lord Mayor's run from York on July 31st, 1880, in 3 hours 37 minutes, which for years was quoted as the *ne plus ultra* of speed, has not only been beaten this summer by the humble penny-a-milers on the 10 o'clock express by 15 minutes, actual running, but was positively 7 minutes slower than the booked timing of their train. Here are one or two special expresses on a rival line. The North Western brought the Prince of Wales from Manchester to London on May 4th, 1887, in 225 minutes. Deducting stoppages, 4 minutes at Crewe, 5 at Rugby, and 6 at Willesden, this leaves 210 minutes for 189 miles. After the death of the Duke of Albany, H.R.H. came up from Liverpool, 193½ miles, in 234 (or, less stoppages, in 223) minutes. When special trains are run from Liverpool for American passengers — and they are run so often as hardly to be properly called "special," they are allowed 4½ hours for the journey, including 16 minutes for stoppages. A train of this kind was run for the "City of New York" passengers on July 23rd last. In the vain endeavour to kill time it loitered 13 minutes at Crewe, 12 at Rugby, and 8 at Willesden; but this did not prevent its being 4 minutes too soon at Euston.

And it does it; but only once, it must be confessed, each way in the twenty-four hours. To say that it reaches Manchester in the same time that the "Dutchman" and the "Zulu" take to Exeter, nine miles nearer, is only to give a faint idea of the speed; for, while the Great Western runs along an almost dead flat, the road from Sheffield to Manchester is 20 miles up one side of the roof of a house, immediately followed by a second 20 miles down the other, and on this part of the road very high speed is, of course, impossible. Accordingly, while the "Flying Scotchman" takes 2 hours and 4 minutes over the 105¼ miles between Grantham and London, and the fastest of the Leeds trains takes just the same, the 2 P.M. to Manchester does the distance in 3 minutes under the 2 hours, or at the rate of a fraction over 54 miles an hour. The "Dutchman," which long held the palm as the fastest train in the world, only averages 53⅕ even as far as Swindon. Two communications in reference to this run were published in the railway papers in the spring of last year. The one records that, starting from the Grantham platform up a gradient of 1 in 200 for 5 miles, the train covered 24 miles in the first 22 minutes. The other mentions that the down train twice out of three times, and the up train five times out of six, get over 60 consecutive miles of ground in 60 consecutive minutes, and that on one occasion the whole 105¼ miles from start to finish were run in 112 minutes.

It would not be fair, however, to give to the Great Northern the whole of the credit of this train. Though the line is Great Northern as far as Retford, to avoid an unnecessary stoppage the Sheffield Company work the train to and from Grantham. Let us go back and trace its course from Manchester, bearing in mind the engineer's calculation, that to maintain the same speed on a gradient of 1 in 112 as on a level implies that an engine shall do three times as much work. From Manchester to Dunford Bridge, at the east end of the great Woodhead Tunnel, which runs at an altitude of more than 1000 feet above sea-level, three miles

through the heart of the Pennine Range, the backbone of England, the distance is 22¼ miles. Roughly speaking, the gradient is 1 in 120 all the way, and the time is 34 minutes, practically 40 miles an hour. Down to Sheffield, 19 miles further, the fall is a little less steep, averaging about 1 in 130. If this were over a line used merely for through traffic, such as the routes north and south of Carlisle, some part of the time lost in the ascent might be made up in a run down the bank at 65 to 70 miles an hour. But here the line is crowded with junctions and colliery sidings; so the 19 miles occupy 25 minutes, or at the rate of a fraction less than 45 miles an hour. Leaving Sheffield, the train runs the 56½ miles to Grantham in 70 minutes, or 48½ miles an hour. This bit, in spite of one sharp climb of 3½ miles near Staveley, is, it must be confessed, hardly as brilliant as the rest of the performance. From Grantham to London, as has already been said, the speed is 54.

I have traced the working of this train thus minutely because up till last summer it was undoubtedly the fastest train in the world. That claim might now perhaps be disputed by the West Coast Edinburgh train, which covers almost exactly double the distance—400 against 203 miles—in exactly double the time, and allows a leisurely 20 minutes' interval for lunch at Preston. This, however, we can still say for the Great Northern. Other companies may level up to it, none are likely to surpass it. What it might do if it had such a thing as uncompetitive traffic, it is difficult to guess, as such a luxury has hitherto never come its way. The largest exclusively Great Northern town is Grantham, and Grantham—which, by the bye, has recently been complaining of its treatment—though it certainly gets a fair share of expresses, can hardly be said to have many of them run for its special use and behoof. Perhaps the Company might come to giving only a half-hearted service, such as the Great Western gives to Cardiff, or the North Western to Holyhead and North Wall, Dublin.

One cannot say, but meanwhile this much at least is

certain, that, as we have seen already, speed and smartness prevail all over the Great Northern system, to an extent that is unmatched elsewhere. Other lines may break out into fine bursts of speed, some may even run highly meritorious expresses, "standing out," in Mr. Foxwell's phrase, "against a background of the dreariest and slowest trains in England"; but 50 miles an hour comes as natural to the Great Northern as 26 miles an hour comes to the great Continental companies, who work that "specially fast" train the Brindisi mail—so it has recently been characterised by the Secretary of the Peninsular and Oriental Company, and he ought to know—at this headlong speed, in consideration of a huge mail subsidy and extra first-class fares from a strictly limited number of passengers. Let us take an instance which will show the general high level of Great Northern performance. When the "Race to Edinburgh" was on in August last, the North Western were timed to run to Crewe (158 miles) in three hours. This was 21 minutes faster than any train that that company had hitherto run. The Great Northern still kept their heads in front, and timed their trains to Doncaster, only 2 miles nearer London, over a considerably harder course, in 6 minutes less. But to do this they had only to improve 9 minutes upon the time that they had made, winter and summer, for years past by one of their ordinary Leeds expresses. As far as Grantham the acceleration over the ordinary timing of the 2 P.M. was no more than 4 minutes.

But the "Race to Edinburgh" deserves something more than a casual mention.* We must not say it is the *ne plus ultra* of railway speed, as it is quite likely that 1889 may see even more remarkable running; but meanwhile the fact remains that the performances of last August are unequalled in railway history. This claim, it is true, has been challenged

* The figures given below differ, I am aware, to some extent from those that have been published in railway journals and elsewhere on this subject. I will not say that they are absolutely accurate, but I have reason to think that they approach as nearly as possible to that unattainable ideal.

in two directions; by Mr. Crake* and others in the columns of the *Times* on behalf of the old broad-gauge expresses of forty years ago, and by the American railway press on behalf of a run on the West Shore on July 9th, 1885. Let us examine the case of the rival claimants. In the four years 1848–52 the Great Western express was timed as far as Bristol 6 minutes faster than the 'Dutchman' of to-day. It was set down to leave Didcot, 53 miles from London, with a stop, 3 minutes earlier than the modern train is timed to pass that station. Very remarkable undoubtedly, and a conclusive argument to prove that the Great Western could, if they chose, go faster than they do nowadays; but, after all, the Midland, in spite of its gradients, sends three trains to Nottingham every day in the same time and one in 5 minutes less, and Nottingham is 5½ miles further than Bristol from London. There can be no doubt that the famous performance of the 'Great Britain' in May, 1848, 53 miles in 47 minutes from start to finish, was a wonderfully fast one. But it is to be remembered that the road is practically dead level (gradient 1 in 1330 against the train), and that the load was only four carriages and van, which, as the old broad-gauge coaches weighed about 7 tons, we may put down as certainly not more than half the weight of the West Coast train.

Besides, no one—except the enthusiastic reporters, to whose vivid imaginations last August "a short tunnel was like a gas jet, suddenly extinguished and suddenly relighted" —ever thought that the rival companies were exhibiting any very exceptional speed for single miles. Their title to fame was not that they occasionally went fast, but that they never went slow. Not that they ran down the slopes of the Chilterns or the Cumberland Fells at 70 or 75 miles an hour—this they did, but dozens of expresses unknown to fame (unless perhaps for their unpunctuality, in which case

* I have to express my gratitude to Mr. Crake for a good deal of curious and interesting information as to these old broad-gauge expresses, with which he has been good enough to supply me privately.

they are still more likely to do it) perform the same feat every day of the year—but that they ran along the level for two and three hours on end at a steady mile a minute, and that even when climbing a steep hillside they never let the pace drop much below 40 to 50 miles an hour. Before any one presumes to match the 'Great Britain' against Mr. Drummond's superb "seven-foot single, No. 123," let him tell us at what speed she emerged from the Box Tunnel coming eastward? What she would have looked like on the Beattock bank with its ten miles of 1 in 80, with 80 tons behind her, it would be unkind to inquire too closely. And now for the West Shore claim.*

It may be said to start with that the West Shore run is "undoubtedly the best on record" in the United States, and we need waste no words to prove that the best in the United States is equivalent to the best in the world outside Great Britain. The run came about in this wise. "Quite a large number of railroad men," says the *New York Times*, "including officials of the Baltimore and Ohio, Wabash, Grand Trunk, and West Shore roads, happened at Buffalo together *en route* for New York. It was decided to see how fast they could move over the new road. At the very start the railroad men had their watches out, and soon the mile posts were flying past every 43 seconds. That speed was held so steadily that the greater part of the run was made at the rate of 45 seconds to the mile, or from 70 to 83

* For much of what follows I am indebted to Professor A. T. Hadley, whose official title, apart from his position as Commissioner of Labour Statistics for the State of Connecticut, is "Instructor in Political Science in Yale College." He has, however, been described as "the only professor of railway economic science in the world." If English railway men could be induced to acknowledge that railway management is something more than rule-of-thumb, and the British public in general, and Chambers of Commerce in particular, could be persuaded that the equitable adjustment of the relations between the railway companies and their customers is not only one of the most important, but one of the most difficult, problems of modern statesmanship, we might hope to have here in England, not perhaps a rival of Professor Hadley, but at least a chair such as that which he so ably fills.

miles an hour. From East Buffalo to Genesee Junction, 61 miles, took 56 minutes; from East Buffalo to Newark, 93·4 miles, 97 minutes; from Alabama to Genesee Junction, 36·3 miles, 30 minutes. The 97 minutes to Newark included stops of 9 minutes, making the actual running time for the 93·4 miles 88 minutes. From Newark to Frankfort, where the conditions for running were not so good as before, the run of 108·3 miles was made in 134 minutes, including 17 minutes for stops. From East Buffalo to Frankfort, 202 miles, the time was 240 minutes, of which 35 minutes were consumed in stops. There was only a single track at that time on the road a good part of the way between Buffalo and Syracuse, and that journey had to be made at reduced speed, especially over the switches. The journey was timed with the utmost care for the purpose of tabulation. In the table there are marked several miles which were made at the speed of 78 miles an hour, one at 84 miles, and the next, between Genesee Junction and Chili, at 87 miles.* New engines to the train at Buffalo, Newark, Frankfort, and Coeymans."

The whole distance from East Buffalo to New York—or rather to Weehawken on the other side of the river—is 422·6 miles, and the time taken on the run was 9 hours 23 minutes. As the Midland, which was largely patronised last summer on account of its jog-trot pace, by the fugitives from the awe-inspiring speed of the rival companies, has been covering the 423 miles from London to Glasgow in 3 minutes less time every day of the week for the past six months, one really is inclined to ask, "Is that all?" especially when we read that "the grades [on the American line] may be taken as practically level though somewhat undulating,"—coming down the valley of the Hudson, one would think that the gradients, on the whole, must be in favour of the train—and when we remember the road that the Midland has to travel. The Midland

* As to this speed for single miles I shall have something to say in the next chapter. Meanwhile, I would ask my readers not to attach too much importance to the statements in the text.

train too must be almost half as heavy again as the West Shore train, which only weighed 64 tons. But then, on the other hand, it must be remembered also that in the States grade crossings, stretches of single line, absence of proper signalling arrangements, and so forth, compel many slacks and halts of which we in England know nothing. Let us see how the two trains compare when this is deducted.

The Midland spends 44 minutes in six intermediate stops. What the West Shore special did is, however, not quite so clear. As given at the time by the leading American railway paper,* there were "20 stops (including 6 crossings and 5 detentions by trains or block signals)" amounting in all to 1 hr. 34 min. On August 10th, 1888, the same paper published a different account, in which only 12 stops of 64 minutes in all were put down. The running speed on the former estimate was 54 miles an hour, on the latter it fell to 51. Professor Hadley writes as follows: "The account in the *Railroad Gazette* of August 10th cannot be accepted without reserve. The writer has only deducted for station stops, while in fact there were several extra stops at intermediate points for grade crossings, &c., which did not appear in the train sheet. . . . I have some doubt in my own mind as to the general averages of running time, because I do not feel wholly confident as to the principle on which the stops were deducted, nor can I by inquiry fully settle my mind as to the matter. That there were more stops than those mentioned in the *Railroad Gazette* of August 10th, 1888, I have no doubt whatever; that so great a deduction may fairly be made as was given in the *Railroad Gazette* returns in 1885 seems to me open to some question."

The West Shore special, therefore, must be admitted to have been faster than the every-day Midland express. Let us assume that it did average 54 miles an hour for the whole distance, a light special, be it remembered, which only ran once, over a road practically level. What were English

* *Railroad Gazette*, July 17th, 1885.

ordinary third-class trains—weighing, the one a good deal heavier, and the other nearly twice as heavy—advertised to do every day of the week last August, over very different roads? The running average on the West Coast, according to the booked times, was 53⅛, on the East Coast it was 54. As a matter of fact, both trains as a rule ran well within their times; but of this more anon. Coming to the best single performances, we find that, on August 13th, the West Coast train covered the 400 miles in 427 minutes of running time, or at the rate of 56⅕ miles per hour throughout; that, on August 31st, the East Coast train took 412 minutes over 392¾ miles, a speed of considerably more than 57 miles an hour all the way.* It is with a feeling of satisfaction that

* In only one instance was the fastest single run made on the same day as that on which the fastest time throughout was obtained. It is perhaps worth while to give the best single performances by each route. They are as follows:—

	Date.	From.	To.	Distance.	Time	Remarks.
West Coast	Aug. 13	Euston	Crewe	158⅛	166	
	Aug. 7	Crewe	Preston	51	50	
	Aug. 7	Preston	Carlisle	90	90	over 920 feet.
	Aug. 9	Carlisle	Edinburgh	100¾	103	over 1015 feet.
East Coast	Aug. 25	King's Cross	Grantham	105¼	106	25 miles of 1 in 200 or worse against the train.
	Aug. 24	Grantham	York	82¾	88	dead slow over Selby swing-bridge.
	Aug. 29	York	Newcastle	80¼	81	
	Aug. 14	Newcastle	Edinburgh	124½	126	with two engines. With one engine the best time was 130 minutes on August 31.

Mr. Wilson Worsdell, the loco-Superintendent of the northern division of the North-Eastern, who was on the pilot, informs me that the time of leaving Newcastle on August 14 was 2 minutes later, and that of arriving in Edinburgh 1 minute earlier than is given in the guard's journal from which my figures are taken. But, lest the times should be called in question, I prefer to stick to the official record. It may be added that a gale was blowing all the time.

one finds that the Great Northern, a line which for years past has unquestionably led the railways of the world in speed in the ordinary every-day working of its ordinary

YORK Four Days Stage-Coach.

Begins on Friday *the* 12*th of* April 1706.

ALL that are desirous to pass from *London* to *York*, or from *York* to *London*, or any other Place on that Road; Let them Repair to the *Black Swan* in *Holbourn* in *London*, and to the *Black Swan* in *Coney-street* in *York*.

At both which Places, they may be received in a Stage Coach every *Monday*, *Wednesday* and *Friday*, which performs the whole Journey in Four Days, (*if God permits.*) And sets forth at Five in the Morning.

And returns from *York* to *Stamford* in two days, and from *Stamford* by *Huntington* to *London* in two days more. And the like Stages on their return.

Allowing each Passenger 14*l.* weight, and all above 3*d.* a Pound.

Performed By { *Benjamin Kingman.*
Henry Harrison,
Walter Bayne's,

YORK TO LONDON—OLD STYLE.

every-day traffic, still remains in front when it comes to be a question of the absolutely fastest performance on record.

No railway man, no layman even who possesses any familiarity with the conditions under which railway work is performed, needs to be told that the difference between an

average of 54 and an average of 57 miles an hour on a run of 400 miles is a very considerable one, and that a victory so decisive over our American cousins, who undoubtedly can teach

GREAT NORTHERN RAILWAY.

Circular No. 6293a.

SPECIAL 1, 2, 3 CLASS DAY EXPRESS

KING'S CROSS TO EDINBURGH.

On and after Monday, 13th August, the 10.0 a.m. down Special Express King's Cross to Edinburgh will run as below, and this working will be continued, on Week-days, throughout August.

		A.M.
King's Cross	**dep.**	**10 0**
Hatfield	pass	10 22
Hitchin	,,	10 37
Huntingdon	,,	11 5
Peterboro'	,,	11 23
Grantham	**arr.**	**11 55**
,,	**dep.**	**12 0**
Newark	pass	12 17
Retford	,,	12 36
Doncaster	,,	12 54
Selby	,,	1 14
York	**arr.**	**1 30**

This train will convey passengers for Edinburgh.

Tickets to be examined and the York tickets collected at Grantham.

The number of vehicles will be restricted to eight. No vehicle to be attached or detached at Grantham.

CIRCULAR 6275a IS CANCELLED.

FRANCIS P. COCKSHOTT,
Superintendent of the line.

KING'S CROSS,
August, 1888.

LONDON TO YORK—NEW STYLE.

us a thing or two in railroad matters, is one of which we have a right to be proud. Of course, there are not a few persons to be found whose superior wisdom enables them to sneer at the whole thing. "What," they ask, "does it matter whether 50 or 100 people, mostly fools, get to Edinburgh at 5.27 or

at 6 o'clock? They are not likely to do anything of any service to humanity when they get there. If the saving of a few minutes is as difficult as you say, why take the trouble and make all this fuss about saving them?" Not being a superior person, one is led by this course of argument to conclude that Darwin too must have been a poor creature, when he pottered about among his pigeons and troubled his head about their beaks growing a twentieth of an inch longer or shorter. But, indeed, it is not difficult to meet these critics with a more direct answer.

Forty years ago, in February, 1848, an important acceleration was announced in the Scotch service. "On and after the first of March," the notice promised, "express trains,"—but only of course for first-class passengers,—"will run between London and Edinburgh and Glasgow in 13 hours." Up to that date the best train had taken 15½ hours. But the gulf between March, 1848, and December, 1888, when passengers can cover the distance in two-thirds of the time at one-third of the cost has not been passed at one bound. As each improvement has been introduced: as more perfect permanent way, more powerful engines, and steadier running rolling stock have encouraged rival traffic managers to underbid their neighbours with faster and faster services, no doubt the superior person has sneered and remarked, "What's half an hour?" Still to most people it is a matter of distinct importance whether the 10 o'clock express from Euston deposits its passengers at Princes Street Station at 5.38 P.M., as it did on August 13th, 1888, or at 1.40 A.M., as it did—if it kept time, which is more than questionable—on February 29th, 1848.

But there is more than this. Conceive what it means to run a train all day long at an average speed little short of a mile a minute. We may take it for granted that permanent way, engines, and rolling stock will all be as perfect as money and skill can make them. Even so, upon how many individuals does sometimes the safety, and always the punctuality, of a single train depend! There are a thousand

platelayers—ordinary working men at £1 or 30*s.* a week—on the road from London to Edinburgh, and each of them must do his part, must watch the line from day to day, and almost from hour to hour, and mark that here a key wants wedging in, there a trenail is working loose, or a fish-bolt needs screwing up. There are two or three hundred signalmen, and each must be on the alert to receive and acknowledge the "be ready" signal, and to pass it on at once to the box in front. The humblest carriage-greaser may bring the 'Flying Scot' to an ignominious halt at a roadside station because he has allowed a pinch of dirt to get into his grease-box. These men, however, are to some extent under the eye of superior officers. But what shall we say of the driver and his fireman? Once the train has got away from the station, for the next two hours they are monarchs of all they survey. There are people who think that a driver is a man who pulls a handle to turn on steam, and then stands and looks at the result till it is time to turn it off again, and that a fireman has only to shovel on coal with no more intelligence than is displayed by the domestic footman. They would know better if they had ever been on the footplate of an engine that was booked to run for two or three hours without a stop.

Mark the infinite solicitude with which the driver looks over his engine before he starts, lest a split-pin should be likely to shake out, or the wicks in his oil cups should be too tight and prevent the oil from flowing, or too loose and let the oil run out, leaving the cups empty before half the journey is accomplished. As the train moves off, the utmost skill is required to give the engine just as much steam as she can take; with too much she would start slipping, and not to use enough is to waste time where every moment may be precious. No sooner are they under weigh than the engineman and his mate have to solve the problem of the scientific application of force. They have got plenty of coal on board, no doubt, but if they are to run from London to Nottingham, or from Newcastle to Edinburgh, they will have

to burn 25 or 30 cwt., and to evaporate, even in the most favourable circumstances, nearer 3000 than 2000 gallons of water, to get there. And the tender holds at the outside but 3500 gallons; so there is need of forethought on a rough day or with greasy rails, if the train is not to stop *en route* for a fresh supply of water. Nor must the coal be pitched higgledy-piggledy into the fire-box. A lump here, and a shovelful there, little and often, is the fireman's motto; otherwise he might choke his fire, and would certainly waste his fuel, and so spoil his engine's position on the weekly coal sheet. Meanwhile the driver's ear is keen to listen to the regular beat of the engine, to know that all is working smoothly; and his eye is strained forward to catch the first glimpse of each signal as it comes into view, and ever and anon cast back to see that all is right with the following train; and his mind is on the alert to question whether any of the signals that show "line clear" may perchance be delivering a lying message, and only calling him and his passengers forward to destruction. And so the time passes, broken only as at intervals a train flashes past on the opposite metals, and the driver signs with his hand to his comrade that all is well.

And then the train slackens down into Nottingham or Grantham, and five minutes later the tale is taken up afresh by a new engine and a new driver. And so it goes on, day after day and night after night, all over England, but when some extra spurt of rivalry leads to performances even more splendid than ordinary, and some of us desire to applaud, we are bidden by the superior persons to stand aside and be silent, for, after all, there is nothing to be proud of in the fact that nowhere but in England can such feats be performed. Nay, we are even invited to pity the poor drivers, who "having gone along the engine to oil a valve, become paralysed with fear, so as to be unable to move forward or backward." Who shall say, after this, that modern travellers' tales cannot match themselves for imagination against the "moving accidents of flood and field" of an olden time? If

the tale be true, it is certainly startling to think what a number of express trains must be careering over the country at this moment in charge of paralysed drivers, with their passengers all unconscious of the risk that they run. But, when it comes to pitying the driver, one feels inclined to ask whether any one ever condoled with Archer, as he came in the winner by a head of a great race at Epsom, because he might have hurt his leg as he shaved round Tattenham Corner with his foot just drawn a hair's breadth clear of the posts. Certainly those who, like the writer, accompanied the 'Marmion,' as she slowed down through Rugby on her way to Crewe on August 6th, will be able to testify that pity was not the emotion depicted on the countenances of the enginemen who watched her passage all down the long line of engines in the Rugby yard.

One word more about danger. It is emphatically untrue that fast expresses are more dangerous than ordinary slow trains. It would be much more accurate to say that the very reverse is the case. With picked drivers and guards and firemen, with the best and newest rolling stock and the most perfect engines the company possesses, with every signalman all down the line on the *qui vive*, it is difficult to see where there comes in any special source of danger. No one has asserted that it is more dangerous to run up-hill at 50 miles an hour than at 30, and, if it is dangerous to run along the level at 60 or down-hill at 70 or 75, then that is a danger that is incurred by passengers in a dozen different expresses all over England all the year round.* There may

* I travelled three times by the 8 hour expresses between London and Edinburgh and timed scores of miles—whenever we seemed to be going exceptionally fast—with a stop watch. Very rarely were we going over 68; only once did I succeed in getting anything as high as 74 miles an hour; only once did I hear of 76 miles an hour being attained. Long after the excitement was over, I went down to Nottingham by the ordinary 10.40 A.M. Midland Edinburgh express, and timed 75 miles an hour, but neither guard nor driver would acknowledge that they had been running fast. Perhaps, however, as imaginative persons took refuge in the slow and sure Midland trains when it was no longer safe to travel either by the West Coast or East Coast, I ought not to divulge this terrible secret.

perhaps have been, not danger, but at least some approach to rashness, in the old days when the North Western sent twenty or twenty-two coaches on the midnight train out of Carlisle for the south, to rock and roll at 70 miles an hour down the steep incline and over the tortuous curves from Shap Summit; there may still be rashness in what Mr. Foxwell appropriately calls the "hurricane descent to Forres" with the Highland express, but a short train of four or five carriages all alike in size and shape and weight, with the couplings screwed tight and the buffers pressing hard against each other, will run over the same course at the same speed, and remain all the time as steady as a rock. As for failures of machinery, let us draw an analogy. Most of us remember the story of the Naval Manœuvres of last summer: how there was hardly an ironclad, or a cruiser, or a torpedo-boat, whose engines did not break down. "Why," it was asked at the time, "should this be? The 'Umbria' and the 'Etruria' are driven across the Atlantic, not in July only, but in the fiercest gales of winter, for a week on end, as fast as ever forced draught can send them. Why do their engines never break down?" The answer surely was, that it is just because the Cunarders are always strung up to the highest pitch of performance that they are equal to the strain. So too here.

I for one should be very sorry indeed to be one of a party who set out to cover the 363 miles between Berlin and Cologne in seven hours. Neither road, nor rolling stock, nor signalling arrangements are adapted for such speed, nor indeed probably could the locomotive staff rise at one bound from their present 36 to our English 54 miles an hour. Fortunately, however, there is no reason to fear that the *Links-rhenanische Direktion* is likely to try any such hazardous experiments. But, when the Great Northern engines are required to run to York at the rate of 54 miles an hour instead of the ordinary 48, it is only to cut the load down from 160 to 110 tons or thereabouts, and the thing is done.

Finally, we are told that punctuality is sacrificed to speed. What the British public desire is moderate speed and guaranteed arrival to time. "Do they?" asked Sir Frederick Bramwell in the course of a discussion one day at the Institution of Civil Engineers. "Suppose a time-table were published with two sets of columns headed respectively 'Slow and punctual trains,' and 'Express trains not guaranteed to arrive with exact punctuality'; which class would be generally adopted? No one would ever think of taking the slow train." The answer is conclusive; but it may be asked, "Is it not possible to have both speed and punctuality?" The reply to this further question is, in the first place, that unpunctuality is by no means so great as is commonly supposed. And this for a very simple reason. The unpunctuality is greatest when most people see it, and precisely because they are there to see it. An express, let us say, carries on the average fifty passengers every day. For 250 days in the year it runs to the moment, but for a week at Christmas, at Easter, at Whitsuntide, and for the entire month of August, it averages a quarter of an hour late. At these seasons, however, it is carrying 200 passengers a day, so that each day's lateness is impressed on the minds of four times as many passengers as are there to mark the every-day punctuality.

Nor is it easy to see a remedy for this state of things. To allow a quarter of an hour at Crewe or York all the year round because it is needed in August, though five minutes suffice for the rest of the year, would be foolish. But to recast the entire time-table of the line for a single month would be simply bewildering both to staff and public. Nor can it reasonably be expected that, precisely at the time when trains are longest and most heavily loaded, they shall be able to pick up time between the stations. Still even now we can say two things: the one is, that it is the line with the most and the fastest expresses that is on the whole the most punctual; and the other, that, the faster the express, the more likely it is to run to the moment. This may sound a

paradox, but the reason is obvious. Expresses as numerous and as fast as those of the Great Northern, for example, would be simply impossible without rigorous discipline, energy, and exactitude, such as is inspired by the keen air of express competition. I was walking along the line of one of our great companies the other day in company with a district engineer. Suddenly he stopped and uprooted a tiny and almost invisible weed. "I always teach my men," was the response to my look of amazement, "that they must keep the road like a garden path. It mayn't matter to the running of the trains, but it's a good thing to keep them up to the mark." In such an atmosphere 50-mile-an-hour expresses grow and flourish. The men take a pride in their work, and guards, porters, and ticket-collectors vie with one another not to waste an unnecessary moment. Here is the result actually attained to Edinburgh last August. The West Coast was twice late—39 minutes in all: once through a trifling accident, and once waiting for the train of an independent company. On the other twenty-five days it averaged over five minutes before time. The East Coast was in, once at 6, and four times after 6: being twice 3, once 7, and once 17 minutes late. On the remaining 23 days it averaged ten minutes before time.

One might give another reason for the punctuality which is in fact attained. Very fast traffic implies few stops, and therefore few opportunities for delay. It also implies light trains. Shorter trains mean in other words more of them; and as there are certain favourite hours for starting, this means a whole batch arriving and departing, the one close upon the heels of the other. The delay of one means therefore the unpunctuality of half a dozen; in other words, the penalty for one aberration from the time-table is so heavy, that no company with watchful and energetic rivals is likely lightly to incur it. Last August the Great Northern started every morning for a week or two the following expresses, to pursue one another for 150 miles down the line; and almost all of them away from a single platform: 10 A.M.,

10.5, 10.10, 10.25,* 10.32, 10.40. On the return journey last September, 6.15 P.M. saw the Manchester express run into King's Cross, followed by the 6.30 Edinburgh and Glasgow, 6.50 Leeds, and 7 P.M. Perth expresses. No wonder a competent critic writes: "The King's Cross porters despatch human beings, and the Finsbury Park people collect tickets, faster than on any line I know."

Hardly sufficient attention has, I think, been paid to the diminution in the length and weight of trains in the last year or two. In 1863, so Mr. Findlay stated in his recent lecture at Chatham, the 10 A.M. from Euston was 312 ft. in length, and weighed, including the engine, 123 tons. In 1887, its length had increased to 652 ft., and its weight to 268 tons. In the interval, it had thrown off the following swarms: 9.30 Birmingham, 10.10 Liverpool and Manchester, 10.40 North Wales and Lakes, and 11 Central Wales, Aberdeen, and Inverness. This summer the 10 o'clock split into three: 10 o'clock Edinburgh, 10.3 Glasgow, 10.30 Perth; and the heaviest of the three had come back in size and weight pretty nearly to the dimensions of 1863. Much the same happened on the Great Northern, and the Midland Scotch express was split into two. This latter company for some time past has found it necessary to send its Manchester expresses through the Derbyshire dales, separate from the Liverpool portion. Mr. Rous Marten describes the ideal English locomotive as one that can draw 150 tons at 60 miles an hour. We have hardly attained this ideal just yet, but the traffic management of the present day seems ready to sacrifice the weight if only so it can get the pace.

When the Great Northern, and the Midland, and the Sheffield Companies lay their heads together, as they do in the case of the Cheshire Lines Committee, to see what they

* A characteristic Great Northern train this: it runs to Scarborough (230¾ miles) in 5 hours and 5 minutes, with just two stops. According to a fascinating volume of romances, entitled 'All about Our Railways,' these two stoppages are at Northampton and Leicester.

can produce in the way of speed, especially when they get the flat surfaces of West Lancashire to work out their designs upon, the result, even for simply local traffic, is apt to be sufficiently remarkable. Witness the Manchester-Southport expresses, which do their 49½ miles in the level hour. There is a tradition, gradually becoming fainter with the lapse of years, that the Brighton Company once did its 50½ miles from London Bridge in the same time: but nowadays only one train can attain to 1 hour 5 minutes, while trains that take as much as 1 hour 20 minutes are solemnly limited to "first class only." But then, though London is ten times as big as Manchester, and Brighton is, one fancies, somewhat more populous than Southport, the Brighton Company have not got to fight against an energetic rival with a shorter mileage. Witness too the wonderful hourly service between Liverpool and Manchester, twenty-eight trains a day, which perform their 34 miles, including a stop at Warrington, in 45 minutes, except four of them which, if we may be forgiven the Hibernianism, run outside Warrington and only take 40 minutes. This said service, when it was first put on, startled the dignified and leisurely North Western not a little. They were compelled to follow suit of course, but just by way of protest,* though their line is 2½ miles shorter, they replied for some time to the four Cheshire Lines 40 minutes' trains by four that dropped to 50 minutes, and two more that allowed themselves a solid hour. Last year, however, the North Western too introduced 40 minutes' trains, but it still upsets the symmetrical arrangements of its service with 48, 50, and 60 minute hybrids.

Some months back the Lancashire and Yorkshire Com-

* Except when, as happened in August, 1888, the North Western gets exhilarated by the novel sensation of record-cutting, its high speed always comes under protest. The tradition that 40 miles an hour is the proper speed for a gentleman still has a powerful sway over this eminently aristocratic line. The Great Northern would have been at Birmingham in 2¼ hours long ere this. Indeed, with a road only 15 miles longer, and not very much steeper, it is doubtful whether it would have left the Great Western any very large share of the Oxford traffic.

pany opened a new line from Pendleton to Hindley, which enabled them to avoid Bolton; and this, with a short cut outside of Wigan, more recently finished, has reduced their route between Liverpool and Manchester from 39½ miles, its former length, to about 34½, or almost the same as the Cheshire Lines road. Altogether there are 13½ miles of new line, which will have cost, when completed, a good deal over half a million. There are four lines laid throughout, and the road has been in all respects constructed for fast running. It was opened throughout on June 1st, 1889, with the result of adding 32 more to the 62 expresses previously existing between Liverpool and Manchester. Such has been the result, within less than two generations, of the "mad projects" and "ignorance almost inconceivable" of George Stephenson. Londoners, who want to know what a local service can be, and ought to be, should go to Lancashire or Yorkshire and study the question. It would be by no means a paradox if a North Countryman were to assert that English expresses are organised, not for the benefit of Londoners at all, but to take the inhabitants of Manchester, and Liverpool, and Leeds up to London as often as they want to go there.

Of one Great Northern service it may be said quite definitely that it is arranged for Leeds and not for London. The Continental mails reach London about 6 in the morning, and the return mail leaves again at 8 in the evening. It makes all the difference to the cloth-workers of Leeds and Bradford, in these days of keen competition with Elbœuf and Elberfeld and a dozen towns more, whether they can get their letters, and bank their bills, and draw their cheques, and send back replies the same afternoon or not. Accordingly a train—run practically for the mails, for at that hour of the morning it can carry but few passengers, leaves King's Cross at 7.40, and reaches Leeds 11.40, while a corresponding up train leaves Leeds at 2.50, and is in London at 6.50. Now Leeds–London, and Paris–Calais are practically identical distances. But the mails from Paris to Calais and back take 10 hours and 50 minutes, as against 8 hours from

London to Leeds and back. If the English trains went at the speed of the French ones, it would mean to the Leeds merchants a day's delay, for an interval of 70 minutes between arrival and departure would, of course, be useless. How many of the members of the Chambers of Commerce, one is constrained to wonder, when they grumble at English goods rates, ever reflect what a large slice of their cake they have already eaten in another form? Still less perhaps do they realise that if they had the good luck to live on the Continent, the railway would fill up its 7.40 mail, inconvenient though the hour may be for passengers, by the simple but efficacious expedient of suppressing its new 9.45 and its improved 10.15 expresses, and agreeing with its neighbour, the Midland, to do the same with the 9 o'clock and the 10.40 as well.*

Closely allied with the question of speed is the use of that peculiarly English contrivance for saving time known as "slipping." Not indeed that "peculiarly English" is absolutely accurate. There is one slip in France; at Le Pecq on the 5.10 P.M. train from the St. Lazare Station. Probably no one needs to be told that a "slip coach" is a carriage attached at the rear of a train by a special form of coupling, which can be undone at any moment by pulling a rope—or, according to a more modern system, by working a lever—in the guard's van, so that the carriage is left behind without the train being obliged to stop. No company makes greater use of this system than the Great Northern, which in this manner is able to afford to its second-class stations accom-

* [I leave this as it was written ten years ago. Corrections bringing the facts in main outline up to date will be found in the Supplementary Chapter. Certainly ten years ago no one imagined what splendid results the Great Northern would attain in 1895, still less how far in 1899 it would have fallen below them. London to Leeds and back in 8 hours, when compared with Paris-Calais and back in 10 hours 50 minutes, was good to dwell on; but of the comparison of 1899, London-Leeds, 3 hours 50 minutes, Paris-Calais, 3 hours 15 minutes, the less said the better. The 4¼-hour Manchester express is a thing of the past. Even the Scarborough express (now 11.30 A M.–4.40 P.M.) is 5 minutes slower than it was. 1899.]

modation to which their intrinsic importance would never entitle them. Take, for example, a little sleepy market-town like Stamford. It has five connections a day from London at the rate of 40 miles an hour and upwards, and an extra one on Saturdays, and all but one are given by slips either at Peterborough or at Essendine. There is probably not another place in all England of equal unimportance that can boast so good a service. It may not be easy to feel dignified as one glides humbly into the station, perhaps even under the charge of a homely old cart-horse, while the tail-lamps of the express, that thundered through half a minute since in the glory of its strength, are fading away in the distance,* but when it is a question of getting home in time for dinner, or crawling down about 9 P.M. by the stopping train, most of us are content to put our dignity in our pockets. To such a point have the Great Northern carried the system, that the 5.30 P.M. slips a carriage at Huntingdon, off the portion that itself is slipped at Peterborough, while at Grantham it attaches a fresh "slip," only in its turn to drop it off at Newark, and then at Retford it picks up yet another, which is left at Worksop. Most railways have one station, a Crewe or a Swindon, at which every train stops, but to the Great Northern there is no place sacred. Two down trains a day ignore Doncaster, one runs through Grantham, three neglect Peterborough altogether, while two more are satisfied to give it the "slip."

For all that, neither company nor passengers could get on without Doncaster, for it is here that all the engines, and carriages, and wagons are built, and hither they return from

* A distinguished novelist published a book the other day in which he stated, apparently on the authority of a signalman, that one English company—the Brighton if I remember rightly—ran its trains without tail-lamps for the sake of economy. One cannot but wonder, whether, if an engine-driver stated that the company had abandoned the use of connecting-rods in order to economise weight, the distinguished novelist would accept and record this statement also with the same implicit and ingenuous confidence.

time to time for repair or renewal. And at Doncaster, first and last, what with the erection of works, and churches, and schools, the Great Northern Company has spent a good deal of money, and not always with the unanimous approval of its proprietary. On one occasion, in the early days of the Volunteer movement, when a sum of £700 was expended in supplying with uniforms the *employés* who had enrolled themselves in a newly formed corps, a few irascible shareholders seem to have thought the whole directorate worthy of impeachment.

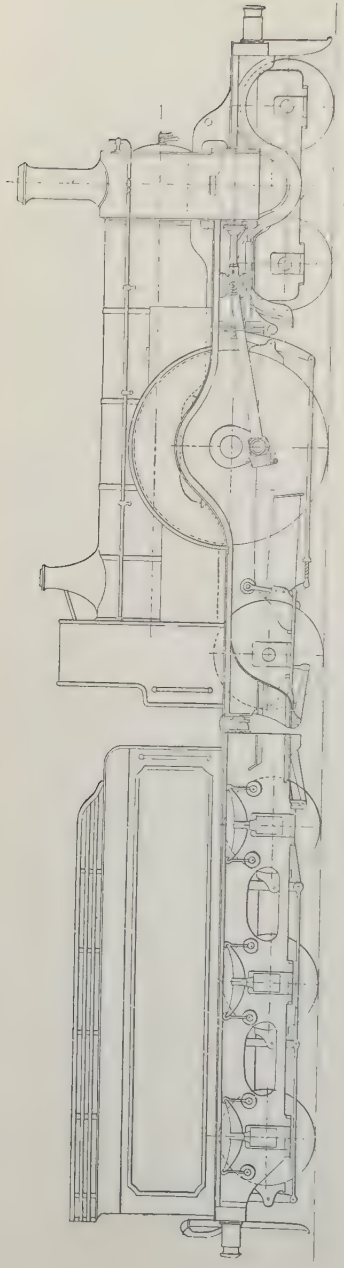
If any one wishes to realise how huge a thing a modern express locomotive is, he can hardly choose a better place for his studies than the shops at Doncaster. As he enters, he will probably find himself gazing up with astonishment at a pair of the great 8-feet driving wheels, and wondering why he never noticed before how huge they were. Mr. Stirling's express engines might fairly be described as belonging to the Doric order of construction. Absolutely simple and unadorned, with but one single band of brass to relieve the monotony of their hue—plain green throughout, except where the polished steel of the piston and connecting rod throws a gleam of light across it—the long line of the immense boiler unbroken even by the accustomed dome, they seem the very model of strength and symmetry. Other companies may go in for "compounds," may raise the working pressure to 160, 170, or even 180 lbs. on the square inch, but the Great Northern engineer holds firm to the maxim *stare super antiquas vias*. Non-compound engines that with steam at 140 lbs. can take sixteen or twenty coaches up the hill for the first ten miles out of London at 40 miles an hour, and then run the remaining 95 to Grantham without a stop at an average speed not far short of 60, are, he says simply, good enough for him. As soon as an organism ceases to develop, it begins, the physiologists tell us, to decay forthwith. It may be, therefore, that the non-compound engine, which would seem to have reached perfection, is doomed to disappear from railroads as com-

pletely as it has disappeared from ships. But at least we may claim that the improvement of type in the two generations that divide the Killingworth of George Stephenson from the Doncaster of Patrick Stirling has not been effected merely by natural selection.*

Linden when the sun was low, and Linden when the drum beat forth at dead of night, were not more unlike than are Doncaster in its work-a-day dress, and Doncaster when prepared for the "Leger" week. In all directions round the station are immense sidings for coal and goods traffic; adjoining the locomotive shops there are miles of line filled as a rule with engines and carriages waiting their turn for repairs. But, when the St. Leger is on, goods, and minerals, and repairs all alike must give way to the race traffic. As a warning of what is coming, a few days beforehand the company's staff receive a "special additional working time-table." Last year its arrangements were comprised in forty-seven folio pages. The stock in the locomotive sidings is swept away, the hopeless "cripples" shut up in the shops, which are closed for the week; those which are capable of movement despatched to find shelter somewhere down the line. The coals and minerals, to the very last wagon, are sent off to their destination, while no new trains, except for a few hours in the dead of night, are allowed to come in to supply their places. Extra signal boxes are erected on either side of the station, so as to cut the block sections into half their usual lengths. Extra staff of all kinds, including a special breakdown gang to repair the telegraphs, should anything go wrong with them, is drafted into the station, and then the Company waits calmly for its traffic.

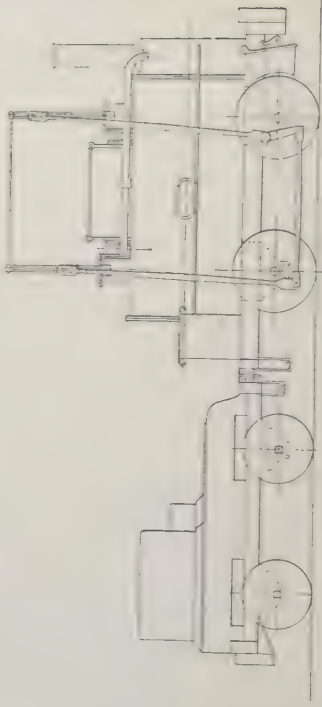
And it has no reason to complain that the traffic is wanting. The station itself is kept mainly for ordinary passengers at the usual fares. And it would scarcely be an

* [Mr. Stirling is gone, and his engines are going. The latest Great Northern type for express work have steam domes, a leading bogie, 4 coupled drivers with a small trailing wheel under the fire-box, and a boiler pressure of 175 lbs. 1899.]



Scale ⅛ Inch = 1 Foot

G.N.R. 8-FOOT "SINGLE."



Scale ⅛ Inch = 1 Foot

S. & D.R. NO. 1.*

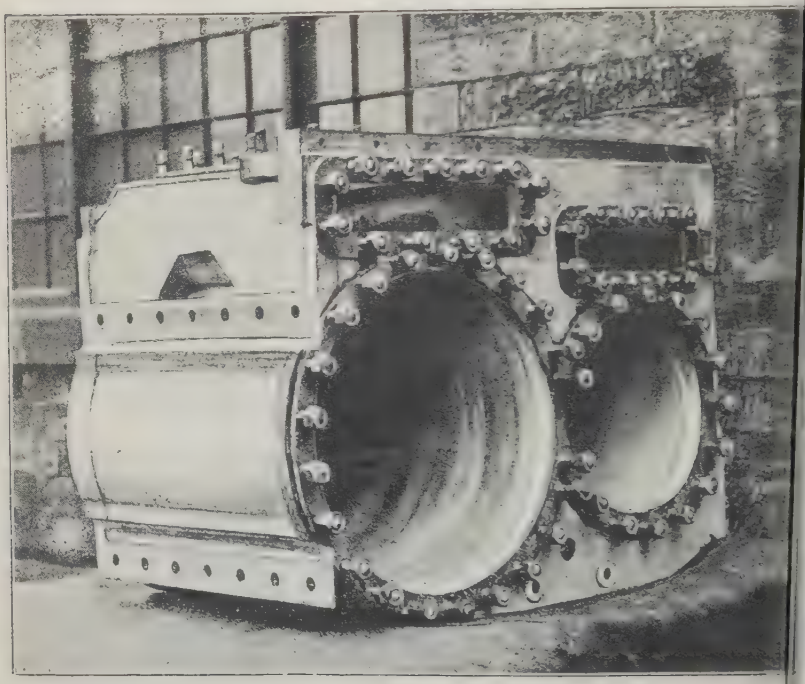
* The 'Locomotion,' the No. 1 of the Stockton and Darlington, placed upon the road in 1825, the first engine on the first public railway in the world, was not indeed a Killingworth engine. It was built by George Stephenson at his Newcastle works. The drawing shows this engine as it now appears on its pedestal beside the Tyne High Level Bridge. It may be added that the No. 1 weighed about 8 tons, the G.N.R. engine weighs about 80.

exaggeration to say that at the busiest time of the day the trains push each other in and out of the platform, for every train almost is running in two portions, and there are relief trains, and private specials, and horse trains to and from every point of the compass. The excursion passengers arrive at and depart from the different sidings. On the Leger Day of 1887, when I visited the place, there were eighty-two train-loads of them from every part of the country, not only from London, and Birmingham, and Liverpool, but from Barrow, Carlisle, and Newcastle, from Chester, Bristol, and King's Lynn. In the locomotive sidings alone there were thirty-four trains drawn up side by side. Each train in the morning runs into the place whence it departs at night, and to each passenger on his arrival is handed a printed notice, giving the number of the train (a number corresponding with that on a huge placard affixed to the train itself), its situation, with directions how to reach it, and finally the hour at which it is timed to start on its return journey. And start they did, at least when I saw them, one about every minute and a quarter from 5.45 to 7.30 P.M., each train of the whole eighty-two punctual to its appointed time. Of all the race-goers, not even excepting the occupants of the luxurious saloons of the various "specials," perhaps the most entirely contented with their day's outing were some parties of Nottingham factory hands who had chartered the third-class saloons that the Midland built some fifteen years ago for use on their original Pullman train.*

To see one of the most formidable rivals of the Great Northern type of engine, we must travel the hundred miles that lie between Doncaster and Newcastle. I have already mentioned that the earliest compound locomotives, in England at least, were turned out of the shops of the Great Eastern Railway at Stratford. Thence has also come one of the latest developments of the principle, in the form of the engines built by Mr. Worsdell, locomotive engineer first to

* The traffic on the Leger Day, 1888, was about 6000 persons, or say twelve train-loads, more than that for the previous year.

the Great Eastern and now to the North Eastern Railway, on what is known as the Worsdell and Von Borries system. A 'Webb' engine, with the bright steel of its low-pressure cylinder shining like a great target on its front as it approaches, must be noticed at the first glance by the least experienced eye. But the Worsdell type of compound,

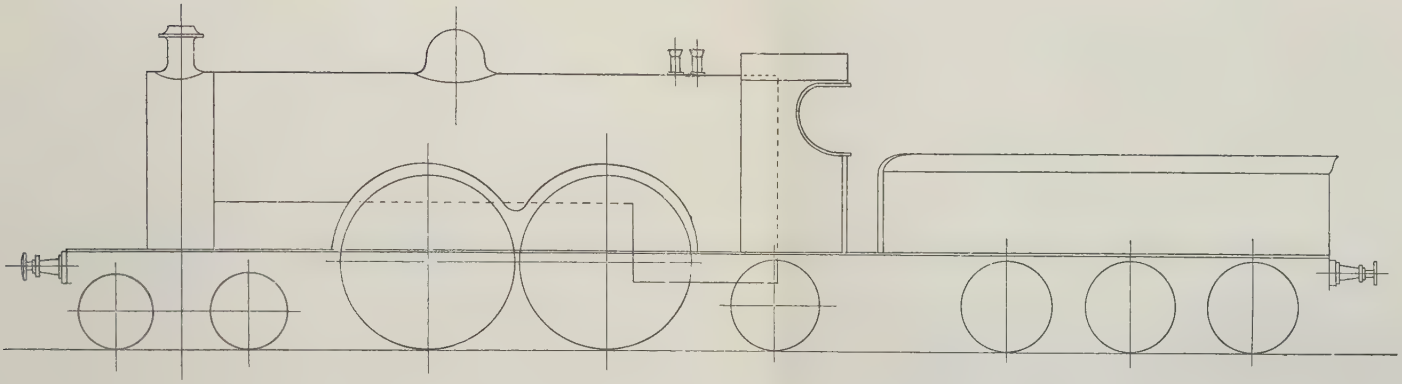


CYLINDERS OF A WORSDELL COMPOUND.

instead of three, has only the ordinary two cylinders, which are placed in the accustomed position, either inside, as in the North Eastern and Great Eastern engines, or outside, as in an engine that is now building in the South Western shops at Nine Elms.

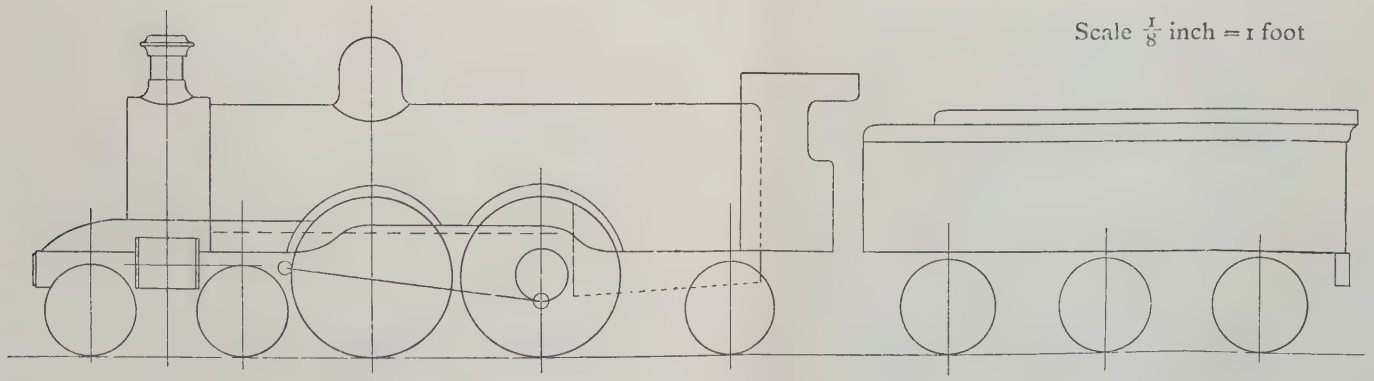
A close observer would, no doubt, perceive that the two are of an unequal size—in fact, the one is 18 and the other

ENGLISH EXPRESS TYPES 1899.



Lancashire & Yorkshire Railway.

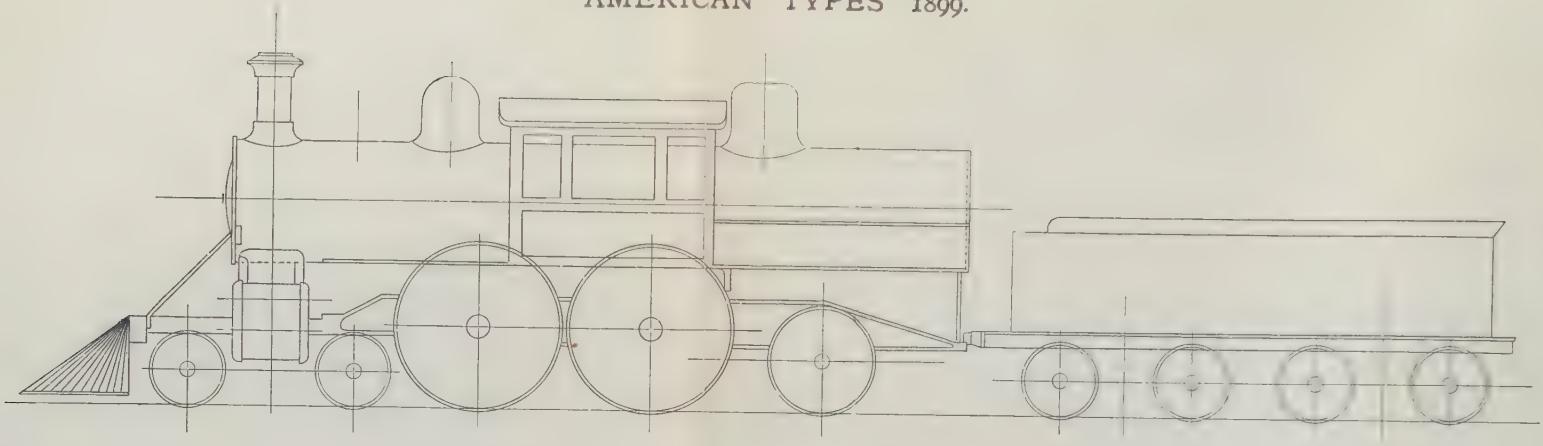
Scale $\frac{1}{8}$ inch = 1 foot



Latest G. N. R. Type.

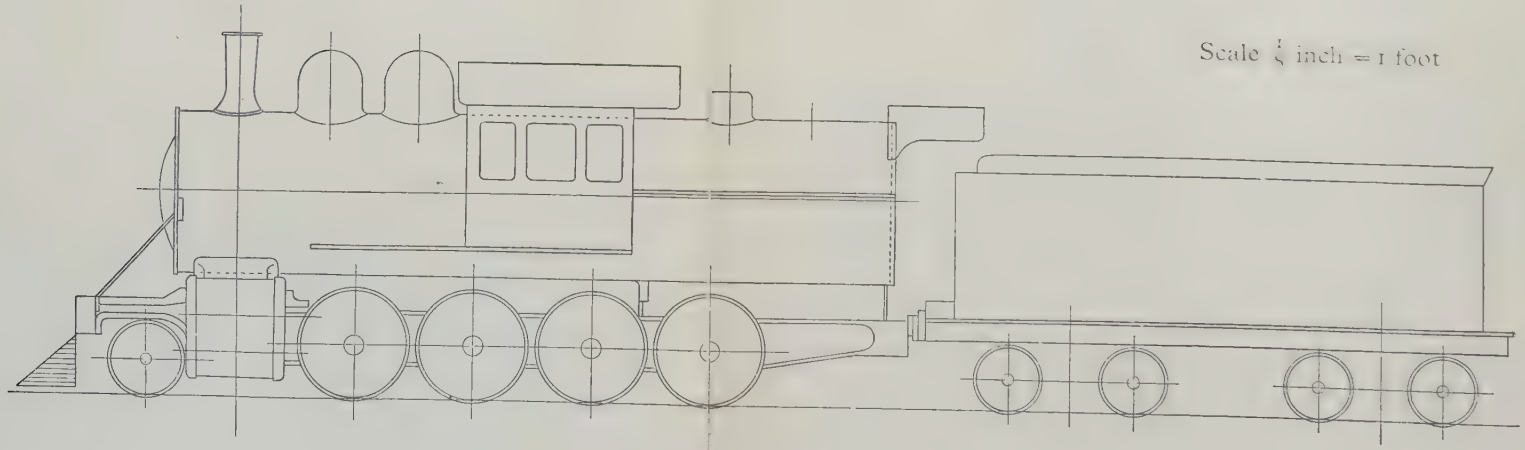
[*To face page* 240.

AMERICAN TYPES 1899.



Atlantic City Flyer, P. & R. R-R.

Scale $\frac{1}{8}$ inch = 1 foot



Lehigh Valley R.R.

[*To face page* 241.

26 inches in diameter; but that is all that is visible from the exterior. Inside, however, the steam, instead of entering the two cylinders alternately, is all admitted in the first instance into the 18-inch cylinder and passed thence by a pipe through the smoke-box into the larger one. It is claimed for these engines that they are both more powerful and more economical of coal and water than engines of the ordinary type, while, as they have no more working parts than usual, they are not open to the objection commonly brought against the North Western compounds of being more expensive to build and to keep in order. The North Eastern directors have, however, determined to submit the question to an exhaustive trial. They have ordered twenty passenger engines and twenty goods engines to be built, identically the same in all respects, except that one half are to be compound and the other half non-compound. An experiment on such a scale as this, extended over a sufficiently long period, ought surely, one would think, to go far towards settling this important question. The larger part of this order has now been executed, and the latest report is that the compounds can give their rivals 5 lbs. (of coal per mile) and a beating.

It is extraordinary how difficult it is to get hold of the facts in regard to the actual performances of compound engines. The statements that from time to time find their way into the newspapers are not—to put it as mildly as possible—calculated to assist the public to arrive at an accurate conclusion on the matter. Let me give one conspicuous instance; it would be easy to produce others. On Tuesday, August 28th of last year, the North Eastern, which had been taking it easy for a fortnight past, and contenting itself with arriving in Edinburgh punctually within the advertised time of 8 hours, began to hurry a little, and covered the 124½ miles from Newcastle in 132 minutes. Next day all the London papers reported that the train had been taken by one of the ordinary engines because they were found to do better work than the compounds. The facts

were these: The train had gone down on the Monday with a compound as usual. On his arrival in Edinburgh, the driver discovered that the white metal was out of the big-end brasses, so he had to leave his engine behind to be re-metalled and take another engine to work his return train. The following day he took this engine back to Edinburgh with the 'Flying Scotchman,' and returned as usual at night with his own compound. And it was with a compound (No. 117) that the last day's run, which was also the fastest of the whole series—at least with one engine—was accomplished. Mr. Worsdell, therefore, can undoubtedly claim that his compounds have fully held their own. Mr. Webb never put one of his on to the Edinburgh train, which, as he very naturally said, did not need such powerful engines, so there was no opportunity of seeing what the 3-cylinder type would do at extreme speeds; but the Glasgow train, which is nearly twice as heavy and had only 8 minutes longer—deducting the stops at Willesden and Rugby—in which to get to Crewe, has been worked regularly by a compound of the Dreadnought class.*

For my own part, after very minute inquiries from all sorts and conditions of men, from loco-superintendents to drivers and firemen, I cannot doubt that the economy claimed has a real existence. On the Great Eastern, for instance, where it is now nobody's interest to "nurse" the dozen compounds that Mr. Worsdell left behind him when he removed from Stratford to Gateshead, it is reported that these engines stand at the top of the list for economy, not only in fuel but water. And as an engine gets through about 8,000,000 gallons of water in the year (or enough to supply a village of some 800 people), and water companies —in London at least—do not as a rule give a supply gratis,

* One of the most common objections to the 3-cylinder type has always been their reported inability to run fast down-hill. I have various records of 75 and 76 miles an hour with Worsdell engines. And higher speed than this is both undesirable and practically unattainable with any engine in existence.

this latter item is by no means unimportant. Still it cannot, I think, be doubted that the tendency at the present moment is away from compound engines for express passenger work. A few years back, loco-superintendents were being called on for engines to draw 150 tons at 40 miles an hour. To-day the requirement is for an engine that can take two-thirds the weight almost half as fast again. But this is hardly the work at which compound engines could be expected to show to the best advantage. It may well be that compounding leads to economy of fuel, and yet that economy may have to be sacrificed to speed.* It has never been argued—to put a somewhat parallel instance—that forced draught on board ship was an economical invention.

Mr. Worsdell and his directors have, however, it is evident, no half-hearted faith in the future of the compound locomotive. For the first time they have applied the principle to single-wheeled engines. Two of these have just been turned out from the Gateshead shops, and three more are nearly ready. Railway men will watch with interest the result of this new departure. If Mr. Worsdell can beat Mr. Drummond's magnificent "7-ft. single," No 123, on the Caledonian—which last August took a train of 80 tons up the 10 miles of 1 in 80 of the Beattock incline in 14 minutes, in spite of a slack down to walking pace half-way up—or Mr. Johnson's "7-ft. 6 singles" on the Midland, he will have accomplished a feat of no ordinary difficulty. What Mr. Drummond's engine costs for coal, I know not, but the

* Let me give an instance from my own experience last summer. On August 13, a big compound lost 17 minutes between Newcastle and Berwick. There was undeniably a very strong wind blowing; but the effect of this was not merely to add to the weight of the train, but to prevent the engine from making steam. The boilers are pressed at 175 lbs., but for the greater part of the distance the pressure was down to 80 lbs. I cannot but think that, had the steam from the high-pressure cylinder gone straight out into the exhaust, say at 80 lbs., instead of going round by the low-pressure cylinder and finally escaping at perhaps only 30 lbs., it would have been able to counteract the down draught of the outside air.

Midland "singles" are working the Nottingham expresses—averaging say 100 tons—at the rate of over 50 miles an hour over a very hard course for an expenditure of not more than 18 lbs. of coal per mile. That any possible engine should show a saving of 20 per cent. on this figure sounds almost inconceivable. Let us hope that Mr. Worsdell may be able to prove it true.*

Except for two or three of its Scotch trains—and even these by no means as fast on North Eastern as they are on Great Northern territory—the North Eastern, as might be expected in the case of a line whose traffic is mainly non-competitive, does not go in for extreme speed. But it may fairly take credit, if not for the fastest, at least for the longest run in Europe—that from Newcastle to Edinburgh, 124½ miles in 2 hours 53 minutes. Not indeed that it is much the longest, for the Midland cover the 124 miles between St. Pancras and Nottingham without a stop. And not only do they do this twice a day, against the North Eastern's once, but they do it in 29 minutes less time over a road that is certainly not easier.† There are several runs in America longer than anything of which we can boast in Europe. The Chicago 'Limited,' by the Pennsylvania route, has one break of 146 miles, and two others of over 130; while the rival train *via* the New York Central does the 143 miles up the valley of the Hudson to Albany in 3 hours 20 minutes without a stop. The two longest runs ever made in England before last summer were, no doubt, those with the "Trent" despatches, which came up from Holyhead to London, 264¾ miles, in 5 hours, with only the

* [As to the modern history of compounds see Supplementary Chapter. 1899.]

† When Mr. Foxwell published his 'English Expresses' four years ago, the Great Northern run from London to Grantham was the only clear 100 miles in Europe. Last summer gave, in addition to those mentioned above, for Great Britain alone, Euston to Crewe, 158 miles; and Carlisle to Edinburgh, 100¾, to Glasgow, 102, and to Larbert, 110 miles; while the Continent, for the first time, gained a place on the list with the 11.15 A.M. from Paris, which runs the 102 miles from Amiens to Calais, without a stop, in 2 hours 17 minutes.

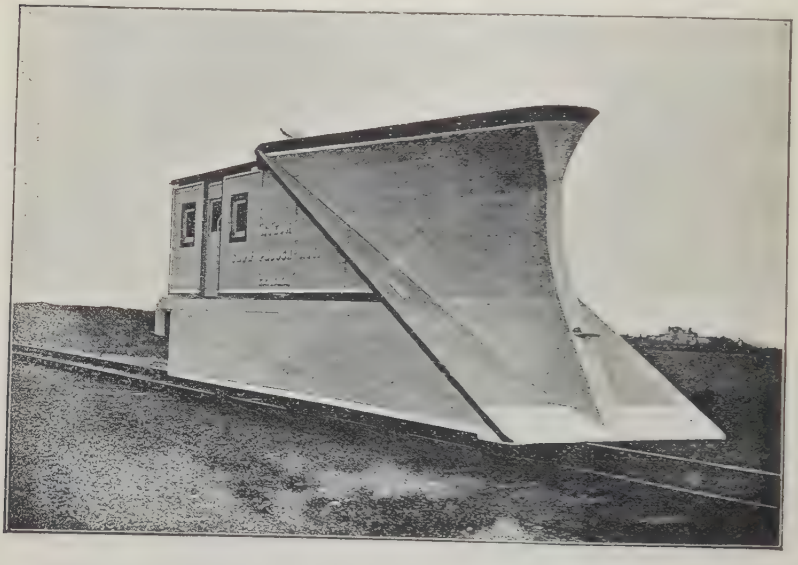
single stop half-way at Stafford to change engines. But for distance without a stop anything we can ever expect to do in this small island of ours fades into absolute insignificance before the marvellous run made on June 1st, 1876, over the Pennsylvania line from Jersey City [New York] to Pittsburg, 439½ miles in 10 hours 5 minutes.* This was by a special train chartered by the Garrett Palmer theatrical company, on its way from New York to San Francisco, which covered the whole distance of 3300 miles in about three days and a half—or at the rate of 40 miles an hour throughout. If this was possible a dozen years back for a special, it seems strange to English ideas that the time of the best ordinary through train between these two points should to-day be not far short of double.†

On the other hand, there have not been many journeys either slower or shorter than that which was taken by five engines, in company with fifty men and a snow-plough, over a portion of the North Eastern line in March, 1886. Here is, in brief, a recollection of the adventure as told by the lips of the commanding officer. "We left Gateshead soon after midnight on Sunday, and we began by forcing our way through a drift 1½ mile long and 14 feet high. If it had been daylight, we should never have attempted it. But then we came to a cutting, where the snow, falling from the banks above, had solidified the snow beneath into a compact mass; and there we stuck. From Monday morning till

* Probably everyone who takes an interest in railways has heard of this run. But, for my own part, I must confess I never believed that the 439½ miles to start with had been run literally without a stop. I find, however, on inquiry that such was the case, and that the wheels never ceased turning from start to finish, but as special arrangements had been made in advance for lubrication, and an extra hand was, I believe, carried on the footplate to attend to this matter, this wonderful feat can hardly form a guide for every-day practice. [But the North Western in 1895 ran through without a stop the whole length of their 300 miles of main line from Euston to Carlisle. It is also worth notice that this small island can still boast the two longest regular runs in the world, Paddington-Exeter, 194 miles, and Euston-Crewe, 158 miles. 1899.]

† [Now reduced to little over four days. Leave New York 5.30 p.m., arrive San Francisco 8.50 p.m. on the fourth day. 1899.]

Saturday night none of us ever had our clothes off. For thirty-eight hours we were without water, except the melted snow, and without food. At last we got the road clear to Alnwick, and sent an engine down. The man swept the town bare, I believe; anyway, he came back with several hams, and roasts of beef, and shoulders of mutton, two or three clothes-baskets full of bread, and lots of tobacco. That storm cost the Company £100,000. Now we're ready for



A SNOW-PLOUGH, NORTH EASTERN RAILWAY.

the next. We've built a good solid house, with a cook's stove, and benches and cushions on which to sleep, and a snow-plough in front, on an old engine frame. But I wish we'd had it in '86."

The newspapers reported last spring that in the snow-storms at the end of February these new ploughs had not come up to the expectations that had been formed of them. So I inquired, and learned somewhat as follows: "We do not use our ploughs for ploughing engines and trains off the

line; and, therefore, as there were five trains snowed up on the single line between Tebay and Kirkby Stephen, it is quite true that the ploughs were powerless, at the outset. But, as soon as we got the trains and their engines out of the way, we went through in grand style. The next week, on the moors near Consett, with three engines we drove the plough through several hundred yards of snow 9 feet deep." So far, indeed, were the Company from being dissatisfied, that they at once began to build two more ploughs of the same design, but with somewhat more luxurious dormitory and culinary arrangements. Fully equipped and loaded, each of these ploughs weighs not less than 30 tons.

Alas! it was not many days after Mr. Wilson Worsdell wrote the words that I have quoted above that a snowstorm came on, worse than any of those of the earlier winter, and, by an ill chance, the snow-plough did very literally set to work "to plough engines off the line," with disastrous consequences. The tale is worth telling, were it only to show that, when all has been done that skill and care can suggest, railway work can never be wholly free from danger. On Thursday, March 15, the north-east coast had an experience of a blizzard almost as terrible as that which struck New York almost at the same time. The 'Flying Scotchman' was blocked at Longhirst, north of Morpeth, and most of the passengers spent the night in the train. The second Scotch express, which leaves King's Cross 10.35 and Newcastle 5.21 P.M., got as far as Morpeth all right, and there it was turned, and sent back to Newcastle on the up line. But it only got through half-way, and finally stuck in the snow close to Annitsford, a mile or two north of Killingworth. The snow-plough had been out all day clearing the roads round Consett, but as soon as it got back to Newcastle, it was at once despatched to relieve the express. It left the Central Station at about 10 P.M. in front of four large engines, and got through without much difficulty till it came alongside the snowed-up train. After a colloquy between the officials, it was agreed that the plough should return to

Killingworth on the down line, cross over on the up line, and plough up to the express, and so release it.

It would, of course, be impossible to see the head-lights of the express through the showers of snow thrown up by the plough; so the bearings of the embedded train were carefully taken, and instructions were given that the engines should shut off steam, and put on the brakes, as soon as they came to a certain bridge. The orders were carefully executed; but whether the brakes were blocked with snow, or that the friction was reduced almost to nothing by the ice-covered state of the rails, is not clear. This much is certain, that the plough failed to stop short of the express, and the plough-share, so to speak, was driven under it—at a speed, it is true, of only two or three miles an hour, but with irresistible force, by a weight of 300 tons of engines pressing on from behind. Running up the plough-share, the front engine of the express crushed into matchwood the house that was built on the framing behind the plough, and finally rested, propped up on the smoke-box of the foremost of the four engines propelling it. In the house there were Mr. Wilson Worsdell, in charge of the expedition, two other officials of the Company, a friend of Mr. Worsdell's, and a reporter of the *Newcastle Chronicle*. At first it was supposed that they had all been killed, but when the *debris* was cleared away, it was found that three out of five of the party had received nothing worse than a shaking, and they were liberated forthwith.

With the other two, however, matters were more serious. Mr. Worsdell's friend was jammed beneath the stove and terribly burned, Mr. Worsdell himself was lying under a heap of heavy tools—jacks, chains, snatch-blocks, and so forth—that had broken their way through from an adjoining store cupboard. The rescue party was obliged to work with the utmost possible caution, lest the huge engine that was hanging on the slant above them should come crashing down and make the destruction complete. It was over two hours before they were finally extricated, and removed to a stores van at the tail of the four engines, and it was not till 8 next

morning that a train could be got to take them back to Newcastle. Mr. Worsdell was laid aside for months by his injuries, and his friend's system received a shock from which he unfortunately never recovered.

One feature in English railways, which is not half as much noticed as it deserves to be, is the very large amount of money they have spent on purposes that are entirely outside the working of trains. The capital that the great railway companies have invested in docks, steamboats, and hotels must amount to many millions sterling. The Great Northern is conspicuous among the leading lines as the one that has kept itself most exclusively to railway business. Once upon a time it put a few thousand pounds into the building of some docks at a Lincolnshire port. But the dock walls failed to keep the water in, and the Company did not repeat the experiment. Its partner, the North Eastern, has spent a good deal of money at Middlesbro' and Hartlepool, but still, in comparison with its sixty millions of capital, the total amount is only fractional. The other working partner, the Manchester, Sheffield, and Lincolnshire, not only was the first English railway to obtain steamboat powers—for a ferry from New Holland to Hull, as long ago as 1848—but it has, with the single exception probably of the Furness Railway (whose tail, Barrow Docks, is big and heavy enough to wag the small dog to which it is nominally an appendage), spent a larger proportion of its capital on non-railway matters than any line in England. On its railways the Sheffield Company has spent under £17,000,000. "Docks, steamboats, and other special items," on the other hand, figure in its accounts for a sum of more than £3,500,000.

Grimsby, therefore, the terminus both of the Sheffield line and of the East Lincolnshire branch of the Great Northern, deserves description as a typical railway port. A generation back it was an insignificant country town, with a mud-bottomed creek in which small coasting vessels could take the ground without fear of damage; to-day it has splendid

docks with miles of quays, and 60,000 inhabitants. But the place is only one vast railway terminus, and might be described as a pocket borough of the Sheffield Company. A vessel comes in with timber from the Baltic. The cargo, almost as soon as it is discharged, is sawn up into railway sleepers, or is made into boxes and barrels, in which to pack the Grimsby fish. Then the vessel goes alongside one of the coal drops, of which there are five, each capable of loading 1000 tons in the twenty-four hours, and with the next high tide she is off on her return voyage. Or it may be that, instead of a Swedish barque, it is a steamer trading from Hamburg, or Rotterdam, or Antwerp. In place of timber, she brings rags for the Bradford mills, barley for the great Burton breweries, cheese and margarine from Holland, finishing up on deck with sheep from Holstein, and emigrants bound for Liverpool on their way to America. In return, the vessel will take back agricultural machinery and portable engines from Clayton's or Marshall's, or some other of the famous Lincolnshire firms.

Everything is arranged so that the goods may not, any more than the ships that bring them, tarry at Grimsby an hour longer than is necessary. The sheep are scarcely landed before they are slaughtered, and skinned, and hung up by the heels, seventy to eighty in a wagon, on their road to Glasgow, Liverpool, Leeds, or Manchester. It is true that when the writer was there, in the autumn of 1887, the warehouses were filled to overflowing with barley. But that was because the English barley harvest had turned out better than was expected, and so the brewers were not in a hurry to take delivery of the supplies which they had contracted for on the Continent earlier in the year.

The writer saw for the first time in action at Grimsby a thing of which he had very often heard—a grain elevator. As there may be others who are in a position of equal ignorance, perhaps the arrangement is worth describing. The sacks as they are brought up from the hold of the vessel are straightway emptied into a funnel on the quay alongside. From

there the corn trickles down slowly by the force of gravity along an underground channel into the basement of an adjacent warehouse. At the mouth of the pipe it falls not on to the floor, but into a well, from which a series of pockets fixed on an endless band works from the lowest to the highest story of the building. In this way the corn is carried up to the top floor, where the pockets, as they turn over to commence their downward journey, empty themselves on to a flat band running horizontally through the warehouse from end to end. At intervals there are cross-bands, at a level a few inches lower, on to which the passing stream can be diverted at any moment by merely adjusting a kind of switch. If the topmost floor is filled, it is only necessary so to adjust the band that the corn shall fall back through a shoot on to another band that is working a story or two lower down. The mechanism is so simple, that nobody seeing an elevator at work for the first time can doubt that, had his lines been cast in the corn trade, he would have invented the whole thing himself.

But Grimsby as a trading port is only one among many. As a fishing harbour, on the other hand, it is not only the first in England, but the first in the world. One complete division of the docks, with separate graving dock and wet docks, of a total area of 23 acres, to say nothing of the tidal harbour outside, is devoted solely to the accommodation of the fishing smacks, of which there are between 800 and 900 registered as belonging to the port. And, in addition to the smacks registered at Grimsby, there are hundreds of others, from Yarmouth, from Lowestoft, and even from as far west as Dartmouth, that habitually land their catch here. The herring luggers only come as far as the outside harbour, put ashore their herrings, some in salt and some packed in hampers with pounded ice, and are off to sea again at once.

The larger smacks come into the inner basin, where, to economise space, they are moored in long lines, stem on to the quays. The instant they have landed their cargo, and have had a short time allowed in which to replenish their

stores of coal and ice, they are required to move on and make room for fresh comers. Stretching along the quay there are ranges of sheds in which the fish is sold by auction, and then sorted, cleaned, packed, and wheeled off on barrows to the railway trucks. These latter are drawn up in line, three deep, on the landward side of the sheds, and as fast as the servants of the salesmen deliver the fish to the truck side, the Company's servants receive it and pack it into the van for its destination. By 11 A.M. or thereabouts, most days, the fish is landed and sold, and the trains leave between 4 and 8 P.M. The bulk, of course, of the produce is for London and the great towns of Lancashire and Yorkshire; and, to show what that bulk is, it may be mentioned that the fish specials not unfrequently need a "pilot" in running up the Penistone bank on their way to Manchester. But there are as many as thirty or forty stations to which vans are despatched direct, and Grimsby fish finds its way as far as to Cornwall, Cardiff, and the west coast of Scotland.

Close beside the fish sheds is a dock, in which cod and lobsters are kept alive for weeks. There are also huge store-houses filled with Norwegian ice, one of which, by the way, took fire not long since, and was burnt down, in spite of the uninflammable nature of its contents. An attempt has been made to introduce artificial ice, which can be manufactured cheaper than the natural product can be imported; but, whether it be prejudice or actual fact, not only the fishermen, but the salesmen themselves, declare that it is not as good for preserving the fish. But then it is whispered, that not a few of the salesmen are shareholders in existing ice-importing and warehousing companies.

That the fishermen do not sell their fish too dear, and that Londoners do not buy their fish too cheap, is a point on which there exists a unanimity truly remarkable; but, when we come to inquire into whose pocket goes the difference between 2*d.* and 11*d.* per lb., matters are by no means so simple. The fishmonger says that his utmost efforts, even with all the altruistic energies of Billingsgate behind him, to

reduce or to keep down prices, are baffled by the greed of the wicked railway. On the other hand, facts are stubborn things, and Mr. Grierson's exhaustive treatise on 'Railway Rates' shows that the highest rate charged for the carriage of fish in Great Britain is under three farthings per lb., and that is for salmon by express train over the 750 miles between Wick and London. As I write, there lies open before me a sheet giving all the rates in force for the 160 odd miles between Grimsby and London. They vary between a fraction over a penny per ton per mile for salt herrings in barrel, and a fraction under $3\frac{1}{2}d.$ per ton per mile for fresh soles and salmon; on the average they amount to $2\frac{1}{2}d.$ It is estimated that the average charge for merchandise in Great Britain is somewhere between $1\frac{1}{4}d.$ and $1\frac{1}{2}d.$ per ton per mile, and yet the draper seldom asserts that any very large amount of the cost of, say, flannel or calico is caused by the charge for carriage from the Lancashire and Yorkshire mills.

But let us look at it from the retail consumer's point of view. What does it cost to send a small quantity the whole distance? The charge for a hundredweight of salmon or soles is exactly 2*s.* 4*d.*, or, roughly speaking, the retail price of one pound. Put another way, the charge is precisely one farthing per lb. If sent by goods train, these rates include cartage and delivery; but, if the consigner sends by passenger train (as in fact he almost always does), there is an additional charge for delivery. How large that charge is may be judged by one instance. Live cod in vans (and "live" fish, it is worth noting, means fish that has been killed after entering port) costs 70*s.* per van, each holding two tons, or 1*s.* 9*d.* per cwt.; for delivery there is an extra charge of 3*d.* per cwt. If we add that these are all what are known as "owner's risk" rates, and that, if the Company binds itself, for example, to pay for the fish that in consequence of a fog or a snowstorm has lost its market, one-fourth more is added, so that the carriage of the salmon costs not $\frac{1}{4}d.$, but as much as $\frac{5}{16}d.$ per lb., we have reckoned up in full the whole black list of the extortions of the railways.

One thing at least is certain; whether it be on the principle that ill-gotten wealth never thrives, or no, the Sheffield Railway, whose shareholders would think themselves lucky if anyone would guarantee them a return of 3 per cent. on their investments, does not wax fat for all its fish traffic. A mile or two beyond Grimsby, the desire to turn an honest penny by every means in their power has led to what is probably a unique development of railway enterprise. At Cleethorpes the Sheffield Company has turned showman. Grimsby itself is in the muddy estuary of the Humber, under the shelter of Spurn Head; but Cleethorpes, with a fine sandy beach and an open sea view, is a favourite place for excursions from the Midland and West Riding towns. A few years back, however, there seemed every prospect that Cleethorpes would disappear into the sea, taking with it the tens of thousands of half-crowns that the railway was wont to receive from the excursion traffic. Inhabitants, who could afford to build a mile or two of sea-wall, there were none. So the Company got a special Act of Parliament, under which they have not only constructed the necessary works, but laid out gardens and walks over the rescued land, built an arcade in which the most exorbitant demands of the rising generation for spades, and buckets, and shells can be readily satisfied, and allotted ground for swings and merry-go-rounds and a switch-back railway. The very donkeys, who in the too brief moments when they are not careering along the sands with the sylph-like form of Angelina on their backs, stand in a space reserved for them in close proximity to the station, pay to the Company their duly apportioned toll.

Most of the great companies have made some experiments of late years in the electric lighting of carriages. If it cannot so far be said that they have met with much success from a commercial point of view, it has not been for want of enterprise in testing the merits of different systems. The North British is at present lighting those of its trains that

run over the underground line across the city of Glasgow on a system of its own. Between the rails there is a third rail elevated and insulated, through which a current maintained by stationary dynamos is constantly passing. On the train there are fixed pulleys, which make a contact with this centre rail, and so obtain a supply of electricity to feed the lamps. But the third rail is only laid through the tunnels, so that, as soon as the train passes into the open air, the electric lights go out. At night, therefore, or in a black fog, the carriages have to be "lamped" in the ordinary manner. This system then, ingenious as it undoubtedly is, and successful as it is understood to be within its own limits, is evidently not capable of adoption under ordinary circumstances. A second plan is to do as was done for several years on the Brighton Pullman trains, to run the lamps from accumulators, which are charged from a fixed dynamo at one or more terminal points. But accumulators are expensive and heavy, and the process of charging them is one that takes time. The plant for charging them is also costly, and, unless it is erected at least at all the principal stations, the traffic superintendent is hampered in his disposal of his rolling stock by perpetual hesitation, whether the supply of electricity will last till the train has completed its entire journey.

Electricians, therefore, are driven to seek, if possible, to obtain their electricity within the train itself. Here also there are two courses open. You may mount a dynamo and a donkey-engine to drive it upon the locomotive or the tender, obtaining the steam from the locomotive boiler. This was done some time back by the Lancashire and Yorkshire, and the Great Eastern, who employed a spherical engine—constructed much on the principle of the small children's toys that one often sees, in which a wheel is forced round by the direct pressure of the steam itself—to work the dynamo. Theoretically correct, in practice the plan was not found to answer, and it was abandoned. Still, at the present time, the North Western has two trains that run between Liverpool

and Manchester lighted on a somewhat similar system. But such a method has one objection, which, except under the very rare conditions that are present here, namely, that the train always runs unbroken between the two terminal points, must be fatal. Detach the engine, and your light not only goes out instantly, but remains out till that particular engine (or, at least, some other with a dynamo upon it) is reattached. If, on the other hand, you can put your dynamo on the train and drive it from the carriage wheels, you are independent of the engine altogether. Five trains so fitted are at work at the present time on the Great Northern, and, as this system seems to have a future before it, it must be described somewhat more in detail. Later on, too, something will be said of what has been done by the Brighton Company in the same direction.

We may note, to start with, that unless the passengers are content to sit in darkness every time the train stops, it is impossible to dispense with accumulators altogether. Further, a carriage runs now one end forward and now the other, and the ordinary dynamo must always be driven the one way. This difficulty is in the Great Northern installation got over by an ingenious arrangement of automatic reversing gear. Again, the accumulators are charged from the dynamo. But an accumulator is, so to speak, like a tank of water on a high tower. If the engineer were to connect his pumps with the bottom of the tank, when the power of the engine was insufficient to overcome the downward pressure of the water stored in the tank, instead of filling it, he would only have provided an outlet for its contents. So with the dynamo. Unless it is running about 450 revolutions a minute; in other words, unless the train is going 15 miles an hour (for the dynamo makes four revolutions for each revolution of the carriage axle), it is not producing sufficient electricity to overbalance that already stored up. Accordingly, what is known as a resistance coil is provided, through which the electricity is diverted when the train first starts. As soon as it has reached a sufficient speed, an automatic switch cuts

out the resistance coil and switches the accumulators into the circuit, to be once more cut out automatically as soon as the speed of the train slackens again.

Each compartment of the train has two small incandescent lights fixed inside the ordinary lamp glasses; and the two lights are on two independent circuits, so that if the one goes out the other remains alight. So far the system has only been applied to some of the suburban "block" trains, which are composed from year's end to year's end of the same carriages. In them not only the dynamos, but also the whole of the accumulators, are in the guard's van. But at the present time one of the East Coast trains is also being fitted, and then, of course, it will be necessary to fix accumulators in each carriage (under the seats or elsewhere) to keep the light going from the time the carriage leaves the train at Edinburgh till it rejoins it, after a run to Dundee or Aberdeen and back. Everybody must wish well to an enterprise which may finally put an end (in main-line trains at least) to the antediluvian and filthy oil-lamps. So far it has hardly got beyond the experimental stage; but the cost will ultimately, it is hoped, be less than that of any other system. The weight, however, about 3 tons per train, is still a somewhat serious consideration.

If anyone wishes to appreciate the engineering progress made in a single generation, he can hardly do better than compare the roof of King's Cross Station, which in its day —only some forty years since—was the largest in the world, with that of the adjoining St. Pancras terminus. But the King's Cross roof has now lost the special interest that formerly belonged to it. Till last year its girders were wood, being composed, one might almost say, of bundles of planks, fastened together and overlapping each other lengthways; then bent round and forced by sheer pressure to assume the shape of a bow. The design was borrowed from the Czar's riding-school at Moscow. There was, however, one obvious objection, that the planks, like a bow when stretched, always

strove to re-straighten themselves, and so exerted a powerful thrust on the outside walls. The west wall was safe enough, for it had the whole range of offices built along it to hold it upright; but the east side, even in spite of its flying buttresses, showed signs of being shaky at an early period, and as long ago as 1869 the span of roof over the arrival platforms was reconstructed with iron girders. When the job was finished, the huge travelling stage that had been erected

THE OLD WOODEN ROOF AT KING'S CROSS.

for the purpose was taken down, and its timbers carefully numbered, and laid aside till they should be required for use on the western bay. It was not till seventeen years more had elapsed that they were again brought into use, but in the course of the years 1886–7 the whole of the roof, 800 feet in length and 91 in height, was successfully renewed. The stage was gradually moved forward, travelling on wheels, from end to end of the station, and, though clocks and lamps had from time to time to be removed to permit its passage,

the most serious accident that it met with was that on one occasion its immense weight crushed to pieces two or three of the stone slabs of the platform.

There is a local tradition on the Great Northern line that one structure even more important than the roof at King's Cross is not perfectly safe, and that is the great Welwyn, or, as it is officially entitled, Digswell Viaduct. I once questioned one of the Company's engineers on the subject, and his reply was amusing. "Yes," he said, "I've often heard myself that the Digswell Viaduct is unsafe. At one time I used to get two or three letters from passengers every week to tell me so. I've been telegraphed for before now on a Sunday morning to go down immediately, and see if all was right. I've never been able to find anything wrong, and I'm glad to say nowadays I'm not much troubled with the question." Sunday indeed is far from being a day of rest to railway engineers, as it affords them their only chance of carrying out repairs and alterations that imply the temporary suspension of traffic. "From midnight on Saturday next, the main line between —— and —— will be closed, and handed over to the Permanent Way Department," is a common form of notice. When new crossings or junctions have to be made, when a bridge girder has to be swung over the line, and so forth, it is always the night of Saturday to Sunday that is selected for the purpose. If the work is not completed by breakfast-time, the passenger trains, if there are any, will probably be worked through on a single line by a specially appointed "pilot-man." The frontispiece shows a piece of high-pressure work of this kind approaching completion at Wickwar, on the Midland line between Gloucester and Bristol. In 20 hours $3\frac{3}{4}$ miles of road were relaid.

Railway passengers owe a debt of gratitude to the Great Northern. No line has been harder hit by the long-continued depression of trade. Severely as the manufacturers have suffered, agriculturists have suffered more severely still, and nowhere more than on the heavy lands of Lincolnshire. This

autumn, for instance, its potato crop, which in ordinary years brings into the Great Northern many thousands of pounds, and for whose accommodation the Company has erected a most elaborate and extensive depôt outside the King's Cross in the Caledonian Road, has turned out almost a complete failure. And Lincolnshire, in which the Company has over a hundred stations, is almost a Great Northern preserve. But the Great Northern, instead of yielding to fate as it well might have done, has striven to the utmost of its power to create new traffic where the old has failed it, not only by improving stations and rolling stock, but actually by adding to and accelerating its already admirable service of trains.

PADDINGTON IN 1845.

CHAPTER VI.

THE GREAT WESTERN RAILWAY.

It would be more than a mere fanciful conceit if we were to compare the great "battle of the gauges," which raged with such fury more than forty years ago, to the yet more ancient strife between the Britons and the English. Like the Britons, the champions of the broad-gauge, under the leadership of their King Arthur, Isambard Kingdom Brunel, performed prodigies of skill and valour; like them, they have been worsted in the struggle; like them, they have retired, defeated but not disgraced, to the fastnesses of Lyonesse, where they have hitherto been left in almost undisputed possession. But though nowadays the fact may be well-nigh forgotten, at one time the victory was trembling in the balance. Not only to Exeter and Plymouth, but to Hereford and Wolverhampton, to Milford and to Weymouth, the broad-gauge metals ran; even in the Metropolis itself, Moorgate Street and Victoria were broad-gauge outposts.

One might indeed carry the simile further, and draw a comparison between the infusion of British blood, deepening as we pass westward through Somerset into Devon, and on through Devon to Cornwall, and the proportion which the broad-gauge traffic bears to the narrow at the present day

over the different sections of the Great Western, as we journey further and further west from London. Or, again, one might point out that, just as the invading English were wont to seize and fortify positions on the coast of their enemy's country, so the narrow-gauge Bodmin and Wadebridge, that for over half a century has remained contentedly isolated from all its neighbours, was one of the very earliest railways in England; and that even the West Cornwall, originally narrow-gauge, and the solitary example of a line once narrow which has since been adapted to broad-gauge,* ran from sea to sea, from Hayle on the north coast, through Camborne and Redruth, to Newnham on the Fal River below Truro, years before ever Brunel had stretched over "Tamar's glittering waves" the colossal spans of Saltash Bridge.

But whatever the broad-gauge may have in common with the Britons of old, it at least does not share the alleged distinction of their modern representatives, who know not when they are beaten. For now well-nigh a quarter of a century the Great Western authorities have realised that further strife is hopeless, that the broad-gauge has been defeated not so much by its own inherent inferiority as by the overwhelming numbers of its opponents. To drop metaphor altogether and come to the plainest of plain prose, in the fierce conflict for competitive traffic—and there is but little traffic in England that is not competitive either with sea carriage or another railway route—a line that was handicapped by a different, though it might be a better, gauge could never hold its own.† Accordingly, bit by bit, first in the Midlands and to the North, next in the West and in Wales, then in Dorset, and Wilts and Somerset, the broad-

* The line between Gloucester and Cheltenham was originally narrow-gauge, then mixed, and now is narrow again, but in its primitive condition it was more properly to be called a tramway than a railway.

† The Clearing House calculation is that the cost of transhipment from broad- to narrow-gauge trucks or *vice versâ* is equal to the cost of carriage for an additional 20 miles.

gauge has been abandoned. To-day out of over 2500 miles of line only 426 is broad-gauge at all, and of this all but 163 is available for narrow-gauge traffic as well. Out of over a hundred trains that leave Paddington or its adjacent goods yards every day, only ten—seven passenger and three goods—run on the broad-gauge metals.

Still, as long as the line between Exeter and Truro is broad-gauge only, the through traffic for the West must be conveyed in broad-gauge vehicles. When the final change comes, and the lines in Cornwall and South Devon become narrow-gauge like the rest, there must of course be a very considerable sacrifice of broad-gauge stock. But at least every effort has been made that the sacrifice shall be as small as possible. For years no new broad-gauge carriage or broad-gauge engine has been built.* The new carriages that are required from time to time, are now all constructed with bodies of the ordinary width, so that at any time they can be lifted off their present broad-gauge under-frames and put upon narrow-gauge ones. Yet more ingenious—the new engines are convertible.† At present they are what is known as "inside framed"; in other words, the axle-boxes are between the wheels. If, some fine morning, the *fiat* goes forth from Paddington that the broad-gauge is to follow the atmospheric principle into the limbo to which are consigned inventions that, though a scientific success, are yet a commercial failure—and if the present depression of trade really does pass away, the *fiat* may come sooner than it is looked for—these engines need only retire for a day or two to the

* It is not quite accurate to say that absolutely no broad-gauge carriages have been built; ten six-wheeled composites were built in 1885. They are employed mainly on the Torquay branch. I am informed also that some of the express engines that pass as "rebuilds" are new throughout "except for the nameplate," and that the 'Great Western,' "a name unknown on the line for eighteen years," possesses not even this drop of blood relationship to its elder namesake.

† A Swindon correspondent kindly informs me that the Bristol and Exeter built convertible engines so far back as about 1870, "but they have come to the scrap-heap before running on narrow-gauge rails."

Swindon shops.* The outside coverings of the wheels will disappear, the wheels will be knocked off the axles, the axles themselves cut short, and then with the wheels refixed inside instead of outside the bearings on which they are supported, they will issue forth again as full-blown narrow-gauge engines. Another instance, in which the coming event is already casting a distinct shadow before, is to be found in Cornwall, where, out of the forty-one viaducts in the eighty miles between Penzance and Plymouth, no less than eighteen have been reconstructed in the last few years. The old ones had room only for a single broad-gauge line, the new ones are built of the standard width for two lines of the narrow-gauge. The new branches too are narrow-gauge only, even when they branch off from a purely broad-gauge line.†

Twenty years back the Great Western and its allies had upwards of 700 broad-gauge engines running. To-day, though the mileage has doubled in the interval, the number has shrunk to 200. But no traveller on the line, unless perhaps he should happen to be also a shareholder, will see without a pang the stately 'Iron Duke,' the wandering 'Tartar,' or the swift-flying 'Swallow,' disappear from the road that has known them for forty years. No engines in the world have so long and so famous a history as these old engines of Sir Daniel Gooch. Save that they have lost the sentry box at the back of the tender, from which the guard used to keep watch to see that his train was duly following, they look to-day, with their great 8-feet driving-wheels, and

* [The "long-deferred but inevitable moment arrived"—to quote the stately words of a great historian—in May, 1892, when those who were fortunate enough to see the long caravans of old-world rolling stock that steamed east from Cornwall and Devon to Swindon through the long twilight of a summer night, and the army of platelayers who took possession of the country at dawn next morning, and worked almost without intermission for 36 hours narrowing the gauge, saw a sight whose interest is, to railway men at least, not likely soon to be equalled. 1899.]

† One inconvenience of this is found in the fact that the rolling stock and engines for these branches have to be mounted on trucks in order to send them to and from the shops at Swindon.

their old-world brass-mounted boilers and brass wheel-covers, just as they must have looked forty years ago, when our fathers gaped open-mouthed at the tale of their achievements.*

And indeed their achievements were, in sober earnest, remarkable enough. The Great Western had from the beginning prided itself upon its passenger service. In the words of Mr. Bourne, who wrote in 1846 a history of the line, it was remarkable "for the great proportion of first-class intermediate traffic, and of persons travelling upon the line with their private carriages;" at Slough, in particular, "the greater part of the traffic was of a very high description." An accompanying plate accordingly gives us a picture of a train, at the tail of which is attached a hooded phaeton mounted upon a carriage truck. The back of the phaeton is turned towards the engine, so that we are permitted to see the faces of a lady and gentleman "of the first quality" who are seated in it.

Naturally, however, travellers of this "very high description" needed corresponding accommodation. "To suit this traffic," not only were "the dimensions of the stations"—Slough, which was pulled down five years since as utterly mean and inadequate, more particularly—"spacious and the interior fittings handsome, with a magnificent hotel," but the carriages were more roomy and more solidly built.† Larger

* There is one alteration that has been made quite recently, though it would hardly catch the ordinary eye, namely, that the driving-wheels, which formerly were plain, now have flanges, or, as our fathers more usually called them, "flanches."

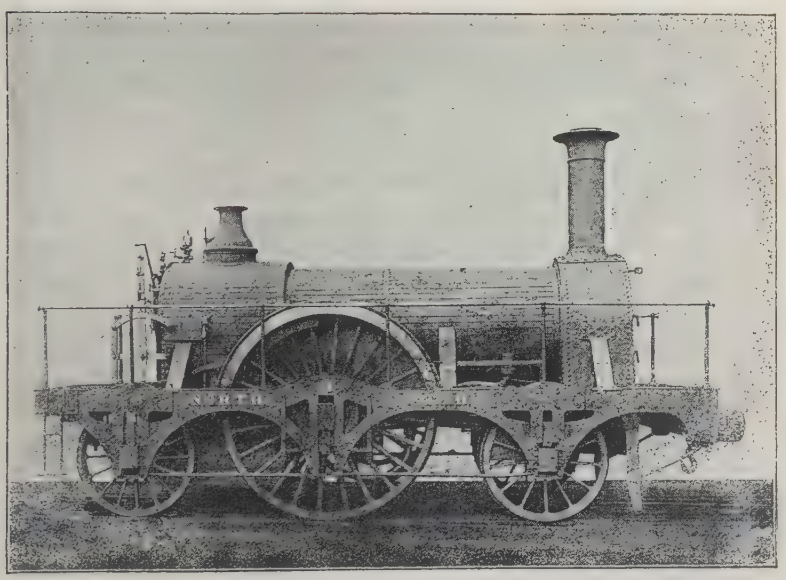
† The hotel still stands as the Mackenzie Orphan Asylum. But with the Slough station went a building much more interesting historically—the Slough signal box, which was erected in 1844, the year after the electric wires had been extended to that point. Within a few months the signalman had the honour of transmitting to London the news of the birth of the Duke of Edinburgh. The following year the Slough box impressed in a dramatic manner upon the imagination of all England the potentialities which lurked in what the elder Brunel described as "a useful undertaking promising to be of national importance." A man, John Tawell by name, committed a murder at Salthill, and got away by the next train to London. Information was telegraphed up to Paddington, and the man was arrested and hanged.

and heavier carriages meant larger and more powerful engines; and so, while the London and Birmingham was contented with four-wheeled engines, none of the Great Western engines ever had less than six. The 'North Star,' which, in 1839, soon after it was placed upon the road, then only open as far as Maidenhead, "attained a velocity of 37 miles an hour," and thereby earned for itself a place in Haydn's 'Dictionary of Dates,' where its name remains unto this day, may still be seen in the shops at Swindon. An illustration of it is given on the next page, and it is not a little remarkable that—except perhaps for the fact that the wooden lagging of the boiler is not cased in with sheet iron—there is hardly anything in the external appearance of an engine built more than half a century since that would attract an ordinary non-technical eye, if she were coupled-up to a train at Paddington to-morrow. The 'North Star,' however, has a curious history. She was built by Robert

Sir Francis Head tells how he was travelling along the line, months after, in a crowded carriage. Not a word had been spoken since the train left London, but as they neared Slough Station "a short-bodied, short-necked, short-nosed, exceedingly respectable-looking man in the corner, fixing his eyes on the apparently fleeting wires and posts of the electric telegraph, significantly nodded to us as he muttered aloud: '*Them's the cords that hung John Tawell.*'" Sir Francis might have told another tale: "A man in the garb of a Quaker," the message handed in began. Now to form the letter "Q," it was necessary to move the two needles together simultaneously, and this, for a reason which electricians will understand, was a stumbling-block to the old telegraph instruments. But the clerk was not to be baulked, and without a moment's hesitation he warned the officials at Paddington to be on the look-out for a "Kwaker." The instrument with which he despatched his message is now to be seen among the Post Office antiquities in the Museum at South Kensington.

The *Bucks Herald* of January 22, 1842, is lost in admiration of these same Slough buildings: "The two rooms appropriated exclusively for the accommodation of royalty have just," we are told, "been fitted up to [*sic*] great splendour for the reception of those distinguished persons who will come by train to attend at the royal christening [of the Prince of Wales]. . . . The chimney-pieces are composed of statuary marble of exquisite workmanship, over which are placed looking-glasses reaching to the ceiling. There are two plate vitrified windows in each room," &c. &c. On the day of the christening the Great Western ran trains every half-hour between Slough and London, and conveyed in all 6375 passengers.

Stephenson & Co., of Newcastle, to the designs of Sir Daniel Gooch, and intended for a Russian railway with a 6-foot gauge. As originally designed she had 6-foot driving-wheels, but the Russian railway having for some reason failed to take delivery, she was altered to the 7-foot gauge and the driving-wheel was also enlarged from 6 feet to 7 feet. One peculiar feature in her construction is that in



THE 'NORTH STAR.'

spite of the width of her framing, the steam-chest is on the top of the cylinders and the eccentrics are outside between the wheels and the frames.

The 'North Star,' however, the first of the Great Western engines, is much more modern-looking than her immediate successors. All the old illustrations represent the Great Western engines with domed fire-boxes, which make the boiler look much as if a garden hand-light had been mounted upon the rear end of it. The great merit of this

form of construction was that very dry steam could be obtained, but a shape that was strong enough for 50 and 60 pounds pressure was impossible when the pressure was raised to 100 or 120 pounds, and in the 'Great Britain' class of 1846 the domed fire-box has already disappeared. Two successors of the 'North Star,' the 'Thunderer' and the 'Hurricane,' were, however, so remarkable as to deserve special and individual notice. They were alike in one point, that they were both built on "Mr. T. E. Harrison's patent principle"—Mr. Harrison being the well-known permanent way engineer of the North Eastern Railway, whose death at a ripe old age has only been recorded in the last few months.

The principle of Mr. Harrison's patent was that the engine was divided into two separate parts, the boiler being mounted on one carriage and the machinery on another. The object of the innovation was, it may be presumed, to get the weight of the boiler as low down as possible, and still leave room for the working parts, an object which, it might have been thought, would have not only been less necessary but also less difficult of attainment in a locomotive of the ordinary type on the broad-gauge than elsewhere. But be that as it may, Messrs. Hawthorn, of Newcastle, built for the Great Western in 1838 the 'Hurricane' and the 'Thunderer' on this principle. The power of the two engines was precisely the same. Each of them had a boiler 8 feet 9 inches long with 135 tubes, giving a total heating surface of 623 feet, and each of them had cylinders 16 inches in diameter with a 20-inch stroke. But here the resemblance abruptly stopped. The 'Thunderer' had four 6-foot wheels coupled, and they were driven, not directly from the cylinders, but "by a very broad wooden-toothed spur-wheel, geared with a pinion-wheel on to one of the coupled-axles," so multiplying nearly threefold the actual piston speed, the exact ratio of the two being 27 to 10. The 'Hurricane,' on the other hand, had a 10-foot driving-wheel, driven directly from the cylinders in the ordinary manner, and

four 4-ft. 6-in. carrying-wheels in addition. No record survives of the performance of either engine, but it is understood that they were not a success, boiler and cylinder power being both insufficient. Nor could these engines in any case have drawn any practicable load behind them. The 'Thunderer' had indeed a weight of 12½ tons on her driving-wheels, but in the case of the 'Hurricane' there was only 11½ tons to distribute over three pairs of wheels. Certain it is that Brunel, who was not usually deterred from innovation by considerations of expense, did not repeat the experiment.

But the 'Hurricane'—which, by the way, has by some accident been rechristened the 'Ajax' in Zerah Cockburn's book—seems to have remained in existence long enough for a whole halo of myth to grow up and encircle her. "When I entered the Swindon shops," writes a gentleman, a former member of the engineering staff, referring to the year of 1847, "experiments were still going on. I remember seeing in the shed an engine called the 'Grasshopper.'* The generally accepted report in the sheds was that this engine had never taken a train, but was built to see what speed could be attained—she had 10-foot driving-wheels—and that Brunel himself had driven her, and that she had attained 100 miles per hour." Truth is, alas! too often prosaic. Even Hamlet never asserted that "Imperial Cæsar, dead, and turned to clay," did actually "stop a hole to keep the wind away;" but the last end of the 'Hurricane' was in very deed that the boss of her 10-foot driving-wheel was used as a counter-weight to balance a coal crane outside Swindon Station.

In 1846, eight years after the opening of the line, the battle of the gauges was raging, and Sir Daniel Gooch's great 8-foot engines were placed upon the road to show

* Mr. Dean, the reigning monarch at Swindon to-day, to whose kindness in this and other matters I am much indebted, suggests, what is undoubtedly the true explanation of this third *alias* of the 'Hurricane,' namely, that it was a shed nickname. It was at least an obviously appropriate one.

what the broad-gauge could do. And then the 'North Star' soon "'gan to pale its ineffectual fires." "The express"—I quote from Mr. Foxwell, whose accuracy is beyond question—"was timed to *leave* Didcot (it stopped there) 57 minutes after departing from Paddington; and the distance, 53 miles, was repeatedly run in from 47½ to 50 minutes." But this was not enough; and the tradition still lingers at Paddington, where the writer heard it from the lips of the General Manager, that a driver solemnly submitted to the directors a proposal that, if they would look after his wife and family, he would take his engine to Bristol (118½ miles) *within the hour*. But the directors, alas! felt it their duty to decline the proposition, and now that railway management has grown old and staid, and that loco-Superintendents shake their heads at a mere 70 or 75 miles an hour as "too fast," we shall never know what a broad-gauge engine could do. Still the 'Lord of the Isles,' which was exhibited at the Great Exhibition of 1851, and now, after running 700,000 miles, rests from its labours in the shops at Swindon (where the present writer saw it some time back, rising majestically from a heap of old lanterns that "deformed its nether parts"), on one occasion brought a train over the 77¼ miles from Swindon to London in 72 minutes. I tell the tale on the authority of an inspector, who was himself in charge of the train as guard. It was therefore his duty to record the time accurately, and once having recorded the performance, he might be trusted, one would think, not to forget it subsequently.

The question, "How fast can a locomotive run?" has been a good deal discussed recently in the engineering papers. The conclusion appears to be that there is no authentic record of any speed above 80 miles an hour. That speed was obtained many years ago by a Bristol and Exeter tank-engine with 9-foot driving-wheels—a long extinct species—down a steep bank. But it has apparently never been beaten.

It is indeed not a little strange how sharply the line

appears to be drawn at 80 miles an hour. Records of 75 miles an hour are as plentiful as blackberries. Records of 80 are exceedingly rare. Records of any greater speeds have a way of crumbling beneath the lightest touch. To refer for a moment back to the West Shore run, mentioned on page 217, with its speeds of 84 and 87 miles an hour. The story of that run has gone the round of the papers of two continents. Professor Hadley has been good enough to inquire into the matter at my request, and writes as follows: "I have had additional information as to the manner in which the West Shore train record was made up. I must change my expression of opinion as to the speed of 87 miles an hour there claimed. I find that both in that case and in the 83 miles an hour speed, there was a slight allowance made for losing headway before a stop, which was so far arbitrary as to destroy the value of the record. No speed higher than 78 miles an hour can be regarded as entirely attested in that run." The truth appears to be that when a speed of 80 miles an hour is reached, the point is attained at which the friction is so great as to absorb all or more than all the power developed by the engine. But whether it is mainly internal or external, and if external, whether it is due chiefly to the resistance of the air or to the grinding of the flanges of the wheels along the rails, is a point on which the authorities appear by no means agreed. The truth is that very little indeed is accurately known as to train-resistance at extreme speeds. The Midland Railway Company are, however, it is understood, at present conducting a series of exhaustive experiments on the subject.*

Eighty miles an hour has, however, not only been attained

* [The question, "How fast can a locomotive run?" is not yet solved; but as far as England is concerned, Mr. Rous Marten's most careful records have undoubtedly raised the maximum from 80 miles per hour to 90. How many of the higher American records will stand investigation, I know not; but the best authorities there seem satisfied that speeds of over 100 miles an hour have been attained. On the other hand, I have reason to say with confidence that the speed of 112 miles per hour claimed for a New York Central engine is not authentic. For my own part I have only once been lucky enough—in America, this summer—to time a train at over 80 miles an hour. 1899.]

but maintained in England quite recently, not indeed on a broad-gauge, but on a narrow-gauge line. Not being at liberty to give names and dates, I will only say that my informant was the loco-Superintendent of one of the great lines, and that he timed the train himself on a gradient rising one in many hundreds against the train. The run came about on this wise. A party of French railway engineers were being shown round England. At one of the stations the question was put to the driver by a member of the locomotive staff, "Tom, would you like to show these French gentlemen how to go a little?" "Shouldn't I, sir!" was the instant response. "Go ahead, then," and off the engine set with a single saloon behind her. In the course of the run nine successive quarters of a mile were timed at the rate of 80 miles an hour. But though the line is one of the most perfect in the country, over which an ordinary 60 miles an hour express glides almost imperceptibly, the saloon shook somewhat. The impression upon the French gentlemen was all that could have been desired, but their English colleagues agreed, when the train drew up at its destination, that it would not, as a rule, be desirable to give drivers *carte blanche* in the matter of speed.

Remarkable as it may seem that our modern engines cannot overtop the speed of 40 years back, the statement of Mr. Rous Marten, whose report gave rise to the whole discussion, that the Great Western expresses, which are allowed 87 minutes for the 77¼ miles between Paddington and Swindon, have a difficulty in keeping time on the down journey; while coming up, as a rule, they have a good deal in hand, seems at first sight yet more remarkable. Between Paddington and Didcot the rise is only 1 in 1320, or, in other words, 4 feet in a mile, and even from Didcot to Swindon it is only 1 in 660. Knowing what the gradient was; knowing, too, that the up and down trains were timed in the working books at precisely the same speed throughout, I was very much inclined to think, when I read Mr. Rous Marten's paper, that he had been misinformed. So I applied to the

authorities, and obtained leave to go down to Swindon and back on the engine of the 'Dutchman,' and see for myself. Incidentally this enabled me to accomplish the fastest piece of advertised travelling in the world.* We were timed to leave Paddington at 11.45 and to be back at 2.45. In fact, we left at 11.46 and I got back at 2.43, having travelled 154½ miles—to say nothing of a five minutes' interval for refreshments—in the 177 minutes.

My first question to the driver was, whether it was true that the down journey was harder than the up? "Certainly," he replied, "there was a great difference." So I explained that on this particular occasion, if he did not keep time, we should miss the up train at Swindon, and thus I should have my run for nothing. There was no fear of that, he thought, and off we set. But, as already said, we were a minute late of starting; the broad-gauge carriages are heavy—20 tons apiece or thereabouts—and we had one more than usual on; then the old broad-gauge engines have not, like a modern Midland or Great Northern engine, much spare power to come and go upon, and take a long time to get up speed; and besides, there was a fresh breeze blowing from the south-west across our track; so in the result we reached Slough at 12.11, three minutes late. Half of our six minutes' "law" was gone, and we had not covered a quarter of the distance. Anxiously I looked at my watch; the driver caught my gesture, and asked the time. A colloquy with the fireman was the result, the shovel was plied somewhat brisker than before, and the miles, that hitherto had taken 65 and 66 seconds apiece, were reeled off in 60 and 61. As we ran through the deep Sonning cutting, the speed rose at once, only to fall again as we came out to meet the full force of

* The nearest approach for the same distance is King's Cross to Doncaster, 1½ miles further, 2 minutes longer. As far as Grantham (105¼ miles) the Great Northern is faster, and the Midland is faster both to Leicester (99¼ miles) and to Nottingham (124 miles), but all these distances are shorter, and run without a stop. The Scotch trains of last August were of course a good bit faster, but their intermediate times were never advertised.

the gale on the embankment before Reading. "Hold tight through the yard," cries the fireman, and with a jerk here and a bump there, we are over the maze of points and crossings, and in a minute more we bend round to the right, and are off to the north before the wind.* We reach Didcot at 12.45, sharp to time, having regained our three minutes, and done the 34½ miles in 34 minutes.

The fireman now thought he could afford time for a drink of cold tea, and even the driver seemed satisfied. But though we had three minutes in hand, 27 minutes for 24 miles, the gradient was somewhat steeper, and the country more exposed, so it was not yet time to give the shovel a rest. We sped on in silence to within a mile or two of Swindon, when the driver said: "If you hadn't been here, I should have been five minutes late into Swindon this morning, and have saved five or six hundredweight of coal. We might have picked up two minutes the other side down the bank to Bath, and another two minutes between Bath and Bristol; and no one would have said anything if we were a minute late at Bristol." With deep regret I heard that I had spoiled his average; and I could only suggest that it was the extra coach rather than the extra passenger that was really to blame.

It should be explained that all the drivers doing the same class of work, working, for instance, the broad-gauge expresses between London and Swindon, are formed into one corps technically known as a "link." Every pound of coal and every pint of oil that goes on to each man's engine is debited to him, and at the end of the week the total is made up and divided by the number of miles his engine has run. The men are then arranged in order of merit, that is, of economy of fuel and oil consumption, on a sheet hung up on the

* The most enthusiastic admirer of the Great Western would find it difficult to admire Reading Station. It is said, with what truth I know not, that the Company hesitates to recast and rebuild it because it would cost £10,000 more to adapt it for mixed-gauge than for narrow-gauge only.

notice-board of the running shed. Of course for a single week, extra load or stress of wind, greasy rails or what not, may affect a man's position, but in the long run (assuming every man's engine to be in equally good condition) the man who comes out top is the best driver, in other words, is the man who can do his work to time—for punctuality of course comes before coal saving—with the most scientific economy of force. In fact, a driver feels the loss of a good position on the coal-sheet much as a boy feels being sent to the bottom of his form at school.

There is no need to describe the return journey. We soon felt, however, the difference between up hill and down hill, which was almost as marked as the difference between rowing up stream and down stream. Now the engine seemed to run almost of itself. Calmly conscious of the strength of his position, the driver remarked, as we ran through Didcot a minute late, that he never needed to trouble to be in time at Didcot. From start to finish the door of the fire-box was wide open, and after we passed Reading it hardly received a hundredweight of coal. By the journey's end, when the engine had completed its day's work, the fire was burnt right down to the bare bars, and yet the gauge showed no diminution of steam pressure—the perfection of good stoking. But even without coal, nothing except the brakes could keep us from running over sixty miles an hour; 57 sec., 56½, 57, 58, was the record of the chronograph for mile after mile. At Slough we were three minutes too soon, and the signalman was not ready for us, and it was a sight to see how in an instant the nonchalance of driver and fireman changed to disciplined activity as they caught the first glimpse of the distant signal at "danger." However, before the speed of the train had been more than slightly checked, the signal dropped, and through we swept, and even a second check at Langley did not prevent us from reaching Paddington two minutes too soon. We flattered ourselves as we alighted that there were not many other people who had ever got back to London from Wiltshire in less than three hours; but

it was nearer three days than three hours before the writer's face resumed its pristine cleanliness.

But at Swindon we have only stepped on to the threshold of the Great Western system, and our time is short: let us push boldly forward not only to Bristol, but on over the second hundred miles of level line that leads us from the muddy banks of the Avon, across Axe and Exe and Parret, round or through the warm red cliffs of the Dawlish coast, an English Riviera on a small scale, alongside of the yet more muddy waters of the Teign, till we finally pause at Newton Abbot, at the foot of the southern slopes of Dartmoor. Here the character of the railway changes with an abruptness that is nothing short of startling. Hitherto the "ruling gradient," as the engineers call it, has been 1 in many hundreds, and for mile after mile the line has run as straight as an arrow. The next stage is an incline of 1 in 40, and henceforward along the whole hundred and odd miles westward to the Land's End there is nothing but climbing hills, only to hurry down again on the further side, swinging round sharp curves now to right and now to left, rattling through tunnels and ringing over viaducts; till at length in its last moments old and long-forgotten habits reassert their sway, and falling abruptly from the high ground at St. Erth, the line runs meekly over some four miles of level marshes into Penzance Station. But as yet we have got no further west than Newton.

As a sign of what is coming, the engine that has brought us from Bristol here leaves us. It is very doubtful if "she" could take her own weight any further, let alone attempting to draw a train. In her stead an ugly unromantic creature, whose scientific name is a "saddle tank," hooks on. Ugly as it is, however, every ounce of its weight rests upon its six driving-wheels, and in nine minutes it succeeds in dragging us over the four miles to the top of Dainton incline; having mounted 280 feet—or more than the whole rise in the 77 miles from London to Swindon—within a space of two miles and a half. Down again with equal abruptness to Totnes; and

then a stretch of 19 miles of as stiff climbing as any to be found in England carries us along the flanks of the hills at a height of 480 feet above sea-level, and so across the watershed that separates the valley of the Dart from the valley of the Plym. It is the same story of ups and downs all the way to Penzance, the Holy-Head of "West Wales"; let us vary the monotony, therefore, by a glance at the famous Cornish viaducts. As already mentioned, there are more than forty of them, with a total length of over 5 miles. In the 8 miles between Devonport and St. Germans alone there are nine viaducts averaging about a sixth of a mile apiece. The biggest of course is the great Albert Suspension Bridge at Saltash, Brunel's last work; but there are two of the timber trestle-bridges, each over a thousand feet in length. Close by Truro there are two together, from which one looks down on to the lofty roof of the new cathedral, with a united length only a few yards short of half a mile. But, picturesque as they are, these skeleton structures are not only unfit for rapid running, but are ruinously costly to keep in repair, and timber is fast being replaced with solid granite from the Company's own quarries. From the largest and finest of the new erections, the viaduct at Moorswater below Liskeard, one can gaze down 150 feet at the miniature Looe and Moorswater Railway passing underneath, whose passengers are required in all cases to take a ticket from the guard immediately upon entering the carriage.*

Over such a course as this, in spite of the additional difficulty caused by the fact that the line is single almost all the way, the up express covers the 112 miles from Penzance to Newton Abbot in four hours, or at the rate of 28 miles an

* I am given to understand that I have libelled the Looe and Moorswater. I deeply regret it, and hereby assure my readers that it does possess a booking clerk, and that it is only at some stations that the guard usurps his functions. Further, I am informed that an Act has been obtained for the continuation of the line to Launceston, and that some portions of the extension are now under construction. Who knows that Looe may not some day, like Falmouth and Milford, advance a claim to be considered as the natural point for the embarkation of mails?

hour. From Newton to Paddington the rate is 43, but the second half of the performance is certainly not more creditable to the Company than the first. For it must always be remembered, in reckoning the speed that may fairly be expected, that the political as well as the physical geography of the district needs to be taken into consideration. It is one thing to run past towns such as Derby, or Wigan, when you

THE OLD MOORSWATER VIADUCT.

have got Manchester and Liverpool, or Glasgow and Edinburgh beyond. But it is quite another to ignore little towns like Liskeard, Bodmin and St. Austell, Redruth, Camborne and Hayle, in order that the handful of passengers to or from Penzance may be brought a quarter of an hour nearer the Metropolis. Still there are not a few people who complain that the English train service is not what it should be, and stands in need of radical reform. Some even go so far as to say that matters will never be placed on a satisfactory footing till the Government, with its vivifying touch and

with that organising genius which is so conspicuous in the management of the War Office and the Admiralty, looses the red-tape bonds in which the commercial enterprise of the Railway Companies has hitherto been swaddled.

Perhaps therefore it is worth while to see how an English company really does compare with its State-owned, or at

THE NEW MOORSWATER VIADUCT.

least State-aided and State-controlled foreign rivals. And the Great Western, which not only is the longest line, but also has an unusually large proportion of non-competitive traffic, may well be taken as a sample of the whole. In the table given below it can certainly not be said that the points selected for comparison are unduly favourable to the English Company. On the contrary, Penzance is only a quarter as populous as Kiel, the smallest of the towns given. The garrison alone of Brest is more numerous than all the inhabit-

ants of the Cornish town. Again, the petty cross-channel traffic of Milford is a bagatelle compared to the commerce of Trieste or Marseilles, which latter town is also the first link in the long chain of rich and populous pleasure cities which encircle the Mediterranean from Hyères to San Remo. Kiel is only a few miles off the high road to Denmark and Sweden, while Dantzic is but just aside from the main thoroughfare between Russia and Western Europe, and the train thither from Berlin given below is described by Mr. Farrer as the best third-class train on the Continent. As for the Trieste line, I may be told it is not fair to include it, as it crosses the Alps. I reply in the first place, that I do not believe the road is harder than that from Newton to Penzance, and secondly, that the Alps are not 370 miles across, and that the train never manages in any part of its journey to run more than about 32 or 33 miles an hour.

Certainly English railways have no need to be ashamed of a comparison which shows that a third-class train, stopping

ROUTE.	Distance in miles.	Time of fastest train.		Speed in miles per hour.	Fares.			Fares per mile in pence.		
		hrs	min.		1st.	2nd.	3rd.	1st.	2nd.	3rd.
London and Milford . .	285¼	8	0	35·65	47/9	35/6	22/8½	2·	1·5	·95
London and Penzance . .	326½	8	55	36·61	63/6	44/6	25/11	2·3	1·6	·95
Paris and Brest .	381¼	13	31	28·20	60/-	45/	33/-	1·8	1·4	1
Paris and Marseilles	540	14	38	36·84	85/-	[63/9]	[46/9]	1·8	[1·4]	[1]
Do. (*train de luxe*)	,,	14	29	37·28	133/-	,,	,,	2·95	,,	,,
Berlin and Kiel (*viâ* Hamburg)	249½	7	12	34·65	37/-	28/-	[19/10]	1·78	1·35	[·95]
Berlin and Dantzic	286	8	40	33	41/-	30/6	21/5	1·72	1·28	·9
Vienna and Trieste	372½	13	56	26·71	78/-	58/	38/-	2·51	1·87	1·22

N.B.—The fastest train is in all cases taken, whether up or down.
Fares enclosed in brackets are not available by the best train.

a dozen times in the first eighty miles, is only fractionally slower than the Marseilles 'Rapide'—'l'Eclair,' the French journals prefer to call it—which is limited to first-class through passengers, and only makes eight halts between Marseilles and Paris. The fastest French train for second-class passengers takes over 18 hours (= less than 30 miles an hour), while third-class through passengers are admitted *par exception* to a train which performs the journey at the magnificent speed of 25 miles an hour. In fairness to the English companies one ought really to compare the London-Penzance train not with Paris-Marseilles, but with Paris-San Remo. Referring to the Riviera service—possibly quite the most profitable bit of traffic in the world—Mr. Farrer writes: "It seems scarcely credible that there is not a single train along the Riviera, winter or summer, which attains to the rank of an express, according to our definition of 29 miles an hour, stops included. One train between Cannes and Mentone, labelled 'Express, 1st class only,' does the journey at 18 miles an hour." So it comes to this, that third-class passengers from, say, Hayle to Bodmin Road, are better treated than first-class passengers between Toulon and Nice. In the last few months, however, the Mediterraneo Company of Italy have put on a new lightning express (*treno lampo*) —called also in the time-bills *direttissimo*—between Turin and Rome. No wonder the Italians are proud of it—it is two hours better than anything they had before. Not only does it cover the whole distance of 413 miles at the headlong rate of 28½ miles an hour, but it actually condescends to carry second-class passengers. So it behoves us in England to acknowledge with due humility that since the first of December the Bodmin-Hayle service is half a mile an hour slower than the express that serves, not only Turin and all Northern Europe on the one hand, and Rome, Naples, Southern Italy and Sicily on the other, but intermediate stations such as Genoa, Spezzia, and Pisa as well.

As for fares, the English first and second-class, though markedly less than the Austrian, certainly look higher than

those prevailing in France or Germany. It should be remembered, however, that they include a much more liberal allowance of free baggage. After all, the first-class fares, in which the difference is most marked, only affect three passengers out of every hundred. As nine Englishmen out of ten go third, the really important question is, What is the third-class accommodation? And to this question there can be but one possible answer: that, while the fares are the same as on the Continent, the carriages and the speed are incomparably superior. The fact that third-class passengers, in a rich and by no means parsimonious country like England, bear a far larger proportion to the total number of persons who travel, than they do in poor countries like Germany or Italy, is the best testimony to the superior advantages of the English third-class.*

Cornwall is famous as a field for the geologist, and its railway traffic might also be not unaptly described as partaking of the characteristics of a geological formation. As we proceed further and further west, we seem to pass every few miles into a new *stratum* of traffic. At Plymouth the talk is of great steamships, whether it be the amorphous conglomerate of chimney stacks and conning towers that passes nowadays under the name of a man-of-war, or the last new addition to the P. & O. or the Royal Mail fleet. At Liskeard granite reigns supreme. A few miles further, Bodmin and Lostwithiel are absorbed in the fattening of beasts for the London market. Par, St. Austell, and Fowey are concerned only to know what percentage of china-clay the heathen Chinee may be induced to pay for in the shape of "grey shirtings." Camborne and Redruth, and the little town of Hayle, which imports their coal and makes their pumps, are in the height of prosperity or the depths of adversity according as the tin from their Wheals and Carns and Pols rises or falls in price in the London market.

[In the Supplementary Chapter this comparison will be found brought up to date. 1899.]

Finally, with the broccoli and early potatoes, which Penzance produces, the mackerel which it catches, and the narcissus which it imports, we pass back again from the mineral to the animal and vegetable kingdoms.

Partly in consequence, no doubt, of the removal of the headquarters of the Peninsular and Oriental from Southampton to the Thames, partly owing to the growth of newer lines such as the Orient, the importance of Plymouth as a port of call has greatly increased of recent years. Seldom a day passes that some great steamer does not either embark or disembark its passengers in the Sound. And the arrangements for so doing are certainly of the most complete and convenient description. I was down there not long since, and the 'Ballaarat' from Bombay, and the 'Orinoco' from the West Indies, were telegraphed about midnight as off the Lizard. The P. & O. vessels, as a rule, run to their time-table with the accuracy of an express train, but the 'Ballaarat' is one of the newest and fastest boats, and arrived three days in front of her contract time. In the early dawn the signalman at Penlee Point flashed the news of the almost simultaneous arrival of the two ships—each line has its own code, whether of flags or rockets—to the look-out man on the Hoe. At once the tenders prepared to start from the Millbay Docks, fine roomy boats with saloon decks — the 'Raleigh,' the 'Drake,' and the 'Smeaton' are their appropriate names—and by the time the vessels had come to anchor under the lee of the breakwater, a tender was alongside each. With the minimum of delay, the passengers—their pale faces a startling contrast to the highly-coloured complexion of the Devonshire folk—were passed with their belongings, not forgetting Her Majesty's mails, down from the towering decks of the great ships to the pigmies alongside. Before ever we had cast off our fastenings, the 'Orinoco' and the 'Ballaarat' had weighed their anchors, and steaming ahead full speed in the ample sea-room of the spacious harbour, they were outside the breakwater by the time we had got inside the shelter of Drake's Island Arrived in the Docks, with in very truth

what the shipowners would term a "miscellaneous cargo" of orchids and bananas, guava jelly and cigars, deck chairs and silver claret-jugs, the passengers had only to step on shore and obtain their tickets in the adjoining waiting-room, and then, as soon as the Customs inspection was completed, take their seats in the railway carriages standing ready on the quay. A fee of 2*s.* 6*d.* per head, in addition to the railway fare, covered all the vexatious dock dues and landing charges, porterage, and boat hire, to which in many places travellers are still exposed. By three o'clock that afternoon Londoners would be at home in their own houses.

The Cornwall Minerals Line, which runs from the north coast at Newquay to the south coast at Fowey, was projected and constructed for the conveyance of ironstone. But the iron mines have not proved a success, and its main business is nowadays the transport of china-clay. Fowey, whence a hundred thousand tons are shipped every year, must surely be one of the most lovely harbours in the world. The sea runs up the narrow channel, deep enough to float big ships moored along the shore, leaving between the water and the hills only just room for the narrowest of lanes and the thinnest line of houses along it. Each inhabitant can choose whether he will step out of his front door into his cart, or out of his back door into his boat. Higher up the harbour than the town are the jetties where the clay is shipped. The largest proportion goes to Runcorn, loose in the hold of the vessel, into which it is shot from hydraulic tips with no more ceremony than so much coal; and from Runcorn it is conveyed either by railway or canal to the Lancashire cotton-mills and the Staffordshire potteries. For export to foreign countries (and the Cornwall china-clay is sent all over the world) it is packed in barrels.

If there be a more lovely harbour than Fowey anywhere, it is perhaps its neighbour, Falmouth. But, alas! Falmouth can boast of little else. In the days of sailing packets it was of some account, but a modern P. & O. vessel can steam down Channel about as fast as the Cornwall Railway can

clamber along the tortuous valley of the Fal, and mail boats know the place no more. A few years back the harbour was a favourite halting-point for ships waiting for orders; but nowadays they get their orders from the signal station off the Lizard, and the only time the harbour looks busy is when a fleet of coasting schooners are prevented by the east wind from getting up Channel. Still, considering the national importance of the position, it is satisfactory to find that the War Office have not neglected its defences. Pendennis Castle is garrisoned by a coastguardsman, a staff-sergeant of militia and his wife, and on the ramparts there are mounted several cast-iron gun-carriages.

A railway may be ready enough, *faute de mieux*, to deal in china-clay, but there is not much profit to be made out of hauling a 10-ton truck a dozen or twenty miles for a few pence per ton. The traffic of Penzance is of a very different kind. In volume it is no doubt small, though Penzance has been known before now to send off 68 truck-loads of broccoli, or 12 tons weight of narcissus, in a single day; and over 800 tons of mackerel in a single week. But its value is very different, and the railway company carries it for hundreds of miles. Of course perishable traffic of this kind is expensive to work. It comes in fits and starts; the rolling stock must be ready on the spot to take it the instant it arrives; and if it fails to arrive at all, must stand idle, earning nothing. Then, at best, the trucks are loaded on the return journey with empty packages only. Further, perishable goods must be conveyed at express speed, and it may often happen that an engine has to be despatched specially with only half or a quarter of a load. Still, on the whole, there is no reason to doubt that the business yields the Company a satisfactory profit. Lately, however, we have been assured, on no less authority than that of the fishmongers and fish-salesmen themselves, that the railways are the only people who make any profit whatever out of the trade in fish. Let us endeavour to bring this assertion to the test of facts.

A Cornish mackerel weighs, say, on the average 1 lb., and

costs the retail London purchaser, at an ordinary fishmonger's shop, 6*d*. The larger fish are mostly Irish, sent to London *viâ* Milford. 6*d*. per lb. equals 56*s*. per cwt., or £56 per ton. The railway rate is 70*s*. per ton, plus an extra 5*s*. per ton for cartage in London, if performed by the Company. But as in every 10 lbs. for which the Company charges, 3 lbs. weight of boxes is included, it would perhaps be fairer to say that the railway rate for the fish is about £5 10*s*. per ton. As the boxes or "pads" are returned from London carriage-free, there does not seem to be any other opening for charge on the part of the Company. There remains therefore over £50 per ton to be divided between the fisherman and smack-owner on the one hand; the fish-buyer, the fish-salesman, the bummeree (if he condescends to touch so plebeian fish at all) and all the other host of forestallers and regraters in the middle; and the retail fishmonger on the other. In what exact proportion the sum is shared, it is not easy for the outside public to learn. The prevailing impression that the fisherman does not receive too large a share, is no doubt correct. If it be true, as the fish-traders say, that the cost of carriage often amounts to more than the total sum that is paid to him, we are then confronted with the fact that the middleman and the retailer receive between them about £44 per ton, or over 700 per cent. on the original cost of the article. The subject is eminently one on which more light is required. At present the railway charges, which are fixed and published, are the only element of certainty in the whole calculation. Perhaps it would be as well if the fish trade also would lay their books open to public inspection.

Meanwhile there is one point which is quite clear. Supposing the railways to carry the fish gratis, and the fishermen to succeed in obtaining the whole of the present cost of carriage, they would receive 1*d*. instead of ½*d*. per lb. as at present. Putting it the other way round, assuming the fishermen to be left as at present, and the distributers to remain content with their share of £44 per ton, the thrifty

housewife might look forward to the gratifying prospect of being able in future to purchase a sixpenny mackerel for fivepence-halfpenny.

For broccoli and new potatoes the rate is 35*s.* per ton ; if, to allow for the weight of the crates and hampers and for the charge for returned empties, we call it 40*s.*, it will be practically correct. Roughly speaking, this is $\frac{1}{5}d.$ per lb. It is impossible to put the retail cost of new potatoes at less than 2*d.*, or of broccoli at less than 3*d.* per lb. So that again it does not appear that the railway absorbs a very large proportion of the retail price. Nor does it seem as if the Penzance market-gardener, who, it is estimated, receives about £72 per acre as the gross return of his land, after deducting cost of carriage and salesman's commission, has any very great reason to be discontented. The Penzance potatoes, however, do not as a rule come to London at all. The London market is mainly supplied by the Channel Islands. Penzance finds its markets in the great towns of the Midlands and the North. To Newcastle the through rate is 46*s.* 8*d.*, to Edinburgh it is 65*s.*—say $\frac{1}{3}d.$ per lb. Efforts have been made of late years to carry this traffic by steamer; but not apparently with over-much success. A cargo of broccoli delayed for a week by a fog, and delivered half rotten, or a load of potatoes carried in the hold of a collier and landed with the thin new skins torn and bruised, can hardly compete on equal terms with the superior condition of railway-borne produce.

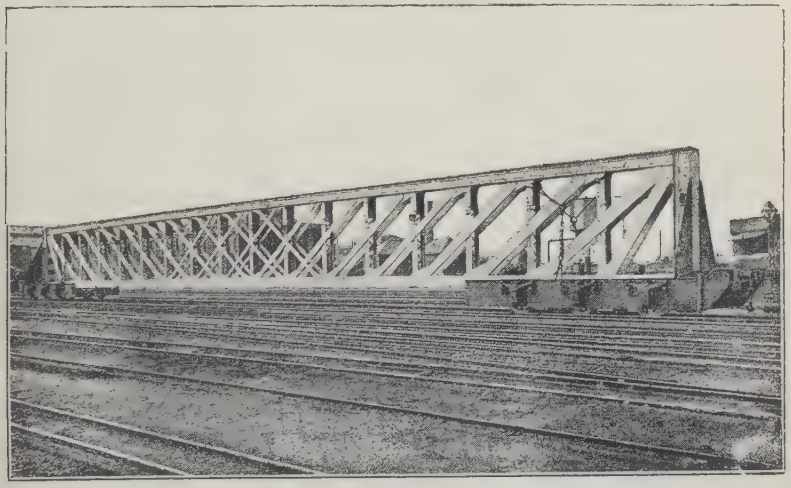
The Scilly narcissus-trade deserves a word of notice. A year or two back it was non-existent. In 1887 the total consignments, up to the middle of April, were about 60 tons, or 30 tons weight of actual flowers. The profits of the islanders, which were very large, were invested not in the savings bank, but in the purchase of new bulbs. Last year, up to the middle of April, nearly 120 tons had already passed through Penzance; just double the amount for the same period in 1887. The flowers are gathered and packed in time to be despatched by the steamers every Monday and

Thursday morning. Leaving Penzance at 5 P.M. the same afternoon by the mail train, they are in London at 4 next morning, and at Covent Garden an hour later. One day last March the mail took 12 tons in four huge broad-gauge parcel-vans piled right up to the roof with neat little boxes. The carriage of this one consignment from Scilly to Covent Garden amounted to upwards of £100, of which the steamer took £30, the cost of transfer at Penzance was £9, and the Great Western got the balance. A satisfactory profit, doubtless; but if we reckon that the contents of each box fetched from £1 to £3 in the flower-shops, and that 250 boxes go to the ton, we shall see that there was a fair margin left for the subsistence both of the flower-farmer and the London florist.

Forty years ago, when the broad-gauge and the narrow met for the first time on the road between Bristol and Birmingham, it was a much-debated question whether, if the gauge were mixed, it would be possible to run broad- and narrow-gauge trucks on the same train. Down on the West Cornwall line, the question has been answered in the affirmative, and mixed trains are run, though of course only at slow speeds. The broad- and the narrow-gauge trucks are marshalled in two separate divisions, and then what is known as a "match-truck," with extra wide buffers and a special form of coupling called a "sliding shackle," is inserted between them. If I might offer a word of warning to anyone contemplating a walk along this line, it would be, not to assume when meeting a goods train that the hind portion of it need be given no wider a berth than the front.

But we have lingered too long in the far West, and must hasten back to Swindon, though the place look as uninviting as it did in the great storm of last February, with the snow piled in huge heaps against the walls and plastered tight under the roof of the platform; while the drifts formed so fast that it was more than the platelayers could do to keep the point-rods and signal-wires free and the points in work-

ing order, and more than the engine could do to get away from the platform without assistance. Swindon is only another Crewe, or another Derby, or another Doncaster, but it needs no skill to find new features of interest to study at each of these huge establishments. A corner of one would furnish out matter to fill a volume of description. In one place we came upon a whole gang of harness-makers, diligently stitching. They are only making head-stalls for use

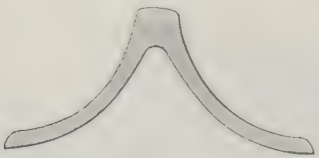


LATTICE-WORK GIRDERS EN ROUTE FROM SWINDON TO BRISTOL.

in the Company's stock of horse-boxes. In another place we find that even in the matter of economy the broad-gauge is not wholly without advantage. A lattice-work girder, 124 feet long and 12 feet 6 inches high, is being riveted together, and the extra height of the broad-gauge tunnels and bridges will make it possible for it to be sent down to Bristol in one piece, to form part of a new widening of the line that the Severn Tunnel has rendered imperatively necessary. Portable riveters, in shape and size like a horse-collar, opening and closing at the pointed end, hang suspended from above, and are fed with water through flexible

coils of copper tubing. Each machine performs the work of a dozen lusty boiler-smiths and strikers.

Outside the locomotive shops we came upon a relic of the remote past, a heap of old rust-eaten Barlow rails. Most people probably know that the broad-gauge rails are not, in the ordinary fashion, fixed by keys into chairs fastened down on transverse sleepers, but are laid directly down upon great beams of timber running lengthways like the rails themselves. This, which was one of the innovations introduced by Brunel, was originally intended to make travelling at high speed more easy than on the ordinary roads.* And so, no doubt, it did in the early days of small chairs and wide-spaced sleepers; but no one nowadays can honestly say that



A BARLOW RAIL.

for smoothness and steadiness the Great Western is either superior or inferior to the North Western, or indeed any other of our great lines. On the other hand, it used to be said that an engine had more difficulty in taking a load up a hill with longitudinal sleepers which gave beneath the tread of the advancing wheels, than it had on an ordinary road where each transverse sleeper, as it was reached, furnished, so to speak, an unyielding foothold. This difficulty too, if it ever had a real existence, has probably been got over by heavier rails and better methods of packing the ballast. But one objection to the longitudinal system which

* Brunel's system as at first designed had an additional feature—the longitudinal sleepers, or rather the cross-ties which held them together and kept them true to gauge, were supported on piles driven down into the ground many feet deep, between the rails. But the additional expense was enormous, the advantage more than questionable, and the piles were abandoned before the line was opened further west than Maidenhead.

remains, and remains insuperable, is its enhanced cost, owing to the large size of the timbers employed; and it was to meet this that the Barlow rail was designed. On page 290 is a section, from which it will be evident that the rail was practically a saddle placed upon the ground. It was intended to be laid directly on the ballast without sleepers or chairs or supports of any kind, and the ballast was intended completely to fill up the interior of the saddle, which was about a foot broad at the bottom. It needs no argument to show that for modern weights at modern speeds such a form is impossible, though for work such, for instance, as a flying line across the Egyptian desert, its simplicity and indestructibility might well make it a very desirable pattern.

At Derby we noticed the mechanical testing-room. Let us here notice the chemical laboratory, which is an equally indispensable part of a great locomotive establishment. Of all the different materials that are analysed here, the two most important are doubtless steel and oils. I have said something already of the importance of soft water for engines, and water undoubtedly takes a high place on the list. Everyone knows that hard water fills the domestic kettle with a deposit of carbonate of lime, which the water, as long as it remains unboiled, is able to keep in solution. But there is another salt which troubles locomotive boilers, from which our kettles are free, and that is sulphate of lime, which is soluble in water boiling in the open air, but is precipitated by water boiling at high pressure. As for steel, it is matter of common knowledge that a trifling percentage of phosphorus, or a few grains too much of carbon, means a brittle, and may at any moment mean a broken, crank-axle, with all its possible consequences.

Oils also have to be analysed, and this for two purposes: to test their viscosity—whether, that is, they are too fluid, and will run through the cups and leave the motion to heat before an engine has gone twenty miles, or whether, on the other hand, they are too thick, and will refuse to run at all;

and also, in the case of mineral oils at least, to see that they do not give off inflammable vapours at a temperature so low as to be practically dangerous. Here is an instance of the importance of a scientific study of this matter. Rape oil is very good as a rule for lubricating purposes. For some parts of an engine—such, for instance, as the interior of the cylinders and steam-chest—it is not only unsuitable, but actually injurious. At the high temperature there prevailing, rape oil is decomposed—in plain English, turns rancid—and eating into the iron, forms a sort of oxide of iron soap. Not only is this in the long run bad for the cylinders, but the soap makes a lather which blocks the ports and prevents the free passage of the steam to and fro.

Crossing the rails into the carriage shops, one begins to wonder whether the skilled mechanic will not ere long be an extinct species. Here we come across a boy of fourteen making curtain rings out of flat discs of wood by a process somewhat similar, and implying about as much mental or bodily exertion as is required to squeeze oil-paint out of a collapsible tube. Close by, a second boy looks on while a copying lathe reproduces, with a scrupulous accuracy that the most skilled hand-turning could never hope to rival, the thickenings and taperings of the oval-shaped handle of a platelayer's pick. A little further on a file, alone and unattended, has taken a band-saw in charge, and is sharpening its teeth, while two studs, nudging alternately from opposite sides, give them the requisite "set." I turned to the foreman and inquired how long it would be before the saw would be taught to get up off the table after the operation and go back to its work. His reply was, "Well, sir, they do say that a man only wants a hammer and a glue-pot to build a railway carriage nowadays." But if the glue-pot has so far remained outside the range of influence of steam power, its brother, the paint-pot, has already succumbed. For of one room the sole occupant was a small engine, that was assiduously grinding and mixing paint. It is true there

was a man looking on, or, as he would doubtless have arrogantly described himself, "in charge"; but the engine went on with its task with a quiet self-confidence that brooked no interference.

In the adjoining paint-shop, carefully muffled up in dust-sheets, was Her Majesty's old broad-gauge saloon. It is long since the Queen has travelled over the Great Western except on her way to or from Windsor, whether from Osborne, from Balmoral, or only from Paddington; and as the Windsor branch is nowadays narrow-gauge, the old coach, which, with its ends shaped like the front of a post-chaise, is interesting as a pattern of a long-extinct style of building, is likely to remain under its cloths for some time. It had a chance of a run once more when the Prince of Wales went down to Truro about a year ago, but in the end a more modern saloon was sent in its place. But the fact that the old coach was only of value as a *monument historique* has not prevented some sacrilegious reformer from laying hands upon it and removing a plate-glass window that for the best part of a generation told the tale of how even Eton boys could not always guide aright the missiles of that deceitful weapon, the catapult. The saloon that the Queen occupies on her journeys between Windsor and London is kept on what are known as the West London sidings, a few miles out of Paddington. Its internal fittings have recently been renovated, but the outside remains untouched; and though the paint is sixteen years old, it is as bright and uncracked as the day it was first put on. While we are on this subject, it occurs to me to wonder how many of my readers could find their way unaided to the Royal waiting-rooms on the platform at Paddington. For my own part, I have walked past them a hundred times, and never noticed them. But there they are, a large waiting-room, lit with electric light in a splendid Venetian chandelier, and ante-rooms as well.

Everybody knows that the Swindon refreshment-rooms, which to our modern ideas seem scarcely as magnificent as

our fathers thought them, were erected by the contractors for the line free of expense to the Company.* The contractors were to maintain the station buildings in consideration of a lease of the rooms being granted them for ninety-nine years at a peppercorn rent. The Company on its part entered into an obligation not only to stop all trains for refreshments at Swindon, but also not to set up, on the main line between London and Bristol, any rival stopping-place which might injure the Swindon receipts. Talking of refreshments, the late Mr. Grierson used to relate with great gusto how, in the early days, passengers travelling from London to Birmingham were allowed time for a substantial meal at Wolverton. The framer of the time-table, thinking only of distance, and knowing that travellers by the mail coaches required a good meal every fifty miles or so, assumed that the same thing would be the case here. So also did the proprietor of the refreshment-rooms and the passengers themselves. According to Mr. Grierson, the blank astonishment of the passengers when they found they were not so hungry as they expected was something worth seeing. Needless to say, nowadays, when Swindon is within an hour and a half of London, the Company would gladly get off from its bargain; but the lease, though almost half its term is expired, has recently changed hands at a premium of

* If the letter of a passenger on the line, addressed by him to the chairman, Charles Russell, Esq., M.P., and published in March, 1843, can be trusted, travellers were not permitted to enjoy all this magnificence quite gratuitously. He complains that the only food provided consisted of "pork pies (perhaps stale), sausage rolls, and Banbury cakes," and that he himself and two friends "disbursed *7s. 6d.* in no time for pork pies and indifferent bottled malt liquor." It must be confessed that he adds: "One of my friends had an attack of indigestion on the road—and no wonder after such a meal." Swindon used, a dozen years back, to be one of the best refreshment-rooms in England, but recently the Banbury cakes and the pork pies (obviously stale) have shown a tendency to resume the upper hand. The Company might do worse than put pressure on the lessees in the matter. If the necessity of restricting profits to, say, a mere 200 per cent. reduced the value of the lease somewhat, perhaps the Great Western would not be much disappointed.

£100,000, and at this price the Great Western scarcely sees its way to deal.*

An hour's run from Swindon brings us to Gloucester, no longer on the main high road to South Wales, as the new route by Bristol and the Severn Tunnel cuts off fifteen miles. It would be interesting to learn, as we spin down the Stroud bank, what proportion of the passengers in the train, even of those who remember the geography that they learnt at school, realise that we have been traversing the defiles of the great chain of the Cotswolds, and have passed from the Thames to the Severn basin. Another hour brings us to the much more remarkable geography of Monmouthshire and South Wales. If anyone looks at the railway map in "Bradshaw," he will find that a square block of country, whose four corners are represented by Newport, Cardiff, Merthyr, and Abergavenny, is black with lines running almost due north and south. If then he will turn to an ordinary atlas, he will find that the railways are replaced by rivers, of which the Usk, the Ebbw, the Sirhowy, the Rhymney, and the Taff are the most important. But the flow of the rivers is not more constant, nor their volume greater, than that of the marvellous and never-ending streams of coal that find their outlets at Cardiff and at Newport. Cardiff, including Penarth, ships ten million tons of coal *per annum*, more than two-thirds of it to foreign ports; the shipments of Newport for 1886 were nearly four million tons, and are increasing rapidly. Newport is handicapped in the contest with its larger rival by the fact that the name of Cardiff is known all over the world, and that Cardiff coal therefore commands a higher price in distant ports. No inconsiderable quantity of coal accordingly which is really raised in the Monmouthshire valleys passes through Newport, in order that it may be shipped under the better-known title.

* [The Great Western has bought up the Swindon lease. The "10 minutes for refreshments" is a thing of the past, and Swindon itself has become a station at which only what the French would call "semi-direct" trains condescend to stop. 1899.]

In the Monmouthshire valleys, the Great Western Company is the proprietor of two collieries, which it bought at the time of the famine scare of fifteen years ago. But though these two collieries only supply a small part of its total consumption, the Great Western has shown no signs of an intention to develop any further this branch of its business, nor has any other English company followed in its footsteps even to this limited extent. A somewhat remarkable fact, when we consider that in America the railways in the coal districts not only mine to supply their own wants as a matter of course, but also are in many cases —the Philadelphia and Reading line, for instance—almost as much coal merchants as carrying companies.

Both Cardiff and Newport have grown more like some mushroom American city than like staid English towns that had a place in history when Robert of Normandy came back from the Crusades, and it is with an unusual sense of incongruity that, as one walks up the obtrusively modern main street of Cardiff, one is suddenly confronted with the stately old castle in whose dungeons that unfortunate warrior spent the latter years of his life. At the beginning of the century, the census gave Cardiff a population of 1018; in 1841 it was only 10,000; in 1881 the houses numbered more than the individual inhabitants of forty years earlier. To-day the population is estimated to be over 120,000. In the same eighty years, Newport has risen from a mere village to a town of 45,000 people. As for the trade of the district, it is on record that at the beginning of the century, "coals were brought chiefly from the Caerphilly Mountains, in bags weighing from 100 to 130 lbs., on horses, mules, and asses, with a woman or a lad driving two or three of them. This was principally done in fine weather, for it was customary to avoid the incidental delay of frost, snow, or bad weather, by bringing in the winter stock at a particular time." Since then the arrangements for moving coal have been considerably modernised. A few months back a vessel went alongside the quay at 8 P.M. on Saturday night. At

12.20 A.M. on Sunday morning she sheered off with a cargo of 1300 tons on board.

Needless to say, both Cardiff and Newport are supplied with all the most recent and most powerful appliances for dealing rapidly with large cargoes. In the common form of coal tip, the truck runs up to the edge of the quay; there it is received on a hydraulic lift, which raises it some eight or ten feet, and then, tipping it up behind, discharges its contents down a shoot into the hold of the vessel. The empty truck then goes back the way it came. To this system there is one obvious objection, that till the empty truck has been got out of the way, another full one cannot be brought up. At Newport an improvement has therefore been made, by which a second high-level line is provided to take the empty trucks straight away back from the top of the shoot, so that the lift goes down empty and is ready to receive a fresh load forthwith. In this way it is possible to get rid of a truck-load of coal every two minutes, or 300 tons within the hour.

But the ship can seldom receive its cargo at this rate. The coal falls in a huge heap at the bottom of the shoot, and then there has to be a pause, till it can be trimmed. So at the Roath Basin, the latest addition to the Bute Docks, another new plan is being tried. The coal truck is emptied bodily into a huge coal-hod, and the coal-hod is swung by a crane on board the vessel, and guided to the exact place where the coal is to lie. A handle is then pulled, and the bottom of the coal-hod, which slopes outwards on all sides from the centre, like the roof of a house, falls off and causes the coal to run out sideways instead of straight downwards. The size of the colliers themselves is on the same scale of magnitude as the Cardiff Docks. Vessels of two or three thousand tons are only in the second class. It is no uncommon thing for a ship to sail with 4000 or even 5000 tons of coal on board. A notice, which is affixed prominently about through the docks, gives an apt idea of the dimensions which the traffic has attained: "Keep off the edge of the quays, as the coal-dust, especially in calm weather, makes the water look like land."

But Cardiff and, in a less degree, Newport will shortly be exposed to a very formidable rivalry. Of the 10,000,000 tons of coal passing through Cardiff in the year, four-fifths are brought by the Taff Vale Company. The Taff line not only works in close alliance with the Bute Docks, but it is, practically speaking, the owner of the docks on the other side of the river at Penarth. That it has done its work well, few people will probably be found to deny. But it has paid dividends of 15 and 17 per cent., and in these days coal-owners and shippers may be forgiven for looking on such returns with a jealous eye. Rumour has it that a deputation of coal-masters demanded certain concessions some time back. "If you want that," was the reply, "you will have to build your docks for yourself." The coal-masters took the hint, and to-day the Barry Docks and the Barry Railway are almost on the eve of completion. The very apple of the Taff Company's eye is the Rhondda Valley, which runs out of the vale of the Taff above Pontypridd. Not only is its steam-coal the best in the world, hitting exactly the happy mean between the bituminous coal of Monmouthshire and the dusty and brittle anthracite of the fields further west, but its quantity is inexhaustible. The Rhondda Fawr and the Rhondda Fach (Big and Little Rhondda) turn out between them over 6,000,000 tons per annum.

Into this happy valley the Barry Company are now going boldly to intrude, and, tapping the traffic of the Taff almost at its fount, are going to conduct it by a subterranean channel through the hills that have hitherto confined it, down to a new outlet into the sea at Barry. Here Nature has gone more than half-way towards constructing a spacious dock, by fixing an island half a mile off the coast, with a low marshy neck of land between. It needed only to carry a causeway from either end of the islet to the mainland, to pump out or dig out the marsh between, and the dock was made. It is now on the verge of completion, and considering that the shareholders in the dock are not only the owners of the railway that leads to it, but also of the collieries that

must feed the railway, it can hardly fail to have a prosperous future before it. It will have several advantages over Cardiff to start with. For one thing, vessels will avoid the difficult navigation through the mud-banks at the mouth of the Taff; for another, the docks will be accessible for a much longer period in each tide than is the case at Cardiff, where the gates can only be opened two hours on either side of high water. Again, Barry Dock will not be handicapped by an expenditure of £50 a day in dredging the entrance, as is the case with their rival. Whether all these advantages will avail to counteract the advantage of that possession, which we know is nine points of the law, time alone can show. Fortunately for the Taff shareholders, they have an ample fund of profit upon which to draw, but it is likely to be long before they see a dividend of 17 per cent. again.*

Meanwhile, to any one interested in railways there is much in the Taff Vale that is deserving of study. Probably nowhere else in the world is there so enormous a mineral traffic worked over a mere hundred miles of line. The great northern railways, which are known as the "heavy" lines, from their large proportion of goods traffic, earn about £3 from goods for every £2 from passengers. On the Furness Railway, which would ordinarily be called an exclusively mineral line, the proportion is 4 to 1, but on the Taff it is nearly 8 to 1. It is not easy to grasp what 8,000,000 tons of coal means. To say that it is a good deal more than all the railways put together bring into London in the twelvemonth sounds startling, but does not help us to see the quantity. I count that to get this amount of coal down into Cardiff implies a train of loaded trucks 6000 miles long running down the hill, and another train with the same length of empty trucks to come back up the hill again. It is in this all-important fact, that the gradient is with the load all the way, that the secret of the 17 per cent. dividend

* [The Barry Company almost from its opening has paid 10 per cent. on its ordinary shares, and remains a standing contradiction to the oft-repeated assertion that no new railway can pay in this country. 1899.]

is mainly to be found. Not that the trucks always go back quite empty. I noticed one long train loaded with pine trees some six or eight inches in diameter, sawn off into six-foot lengths, that were on their way to supply props for the workings of a single colliery.

As already said, compared to this huge mineral traffic, the passenger traffic is a bagatelle, but still, absolutely speaking, it is by no means insignificant; and it is worked in what is certainly an efficient and probably an economical manner. Practically every train stops at every station, and all the seven trains that run through in the course of the day from Cardiff to Merthyr and back have connections, both up and down, into all the other three valleys—the Big and Little Rhondda, and the Aberdare Valley—which open on to the main line. There are probably no colliery villages in all Great Britain with as good a service as those on the Taff Vale. If anyone needs to be convinced that it is for the public interest that railway companies should be prosperous, he cannot do better than go to Merthyr and compare the Taff rolling stock, lighted with gas and fitted with continuous brakes and all the modern improvements, with the carriages belonging to some of the other Welsh companies that use the station. Perhaps it is owing to the more impulsive Celtic temperament that Welsh railways forsake the golden mean of a steady 4 and 5 per cent. and descend by leaps and bounds from the 17 per cent. of the Taff and the 8 per cent. of the Rhymney to a point where dividends on the preference stocks are rarities, and even the debenture interest is not always forthcoming. The Dorstone and Pontrilas line, which rejoices also in the magnificent, if somewhat Chuzzlewitesque, title of the Golden Valley, is, I am credibly informed, the possessor of one engine, two carriages, and one van, and its manager is compelled to suspend the service over his line altogether, whenever the Company's locomotive stock goes into the shops for repair.

It is not, however, only for the sake of making invidious comparisons that it is worth while to go to Merthyr. The

town itself, with its long unlovely streets of small houses, relieved by larger and unlovelier public-houses and chapels at alternate corners, is perhaps more blankly uninteresting than any other of its size in Europe. But on the hill, just outside it, may still be seen the remains of one of the old original tram or plate roads, running along one side of the turnpike road.* The tramroad must have been in use for a considerable period, for the rails or plates—though they are all alike in this, that the flange is on them, and that the wheel to run on them must have had an ordinary flat tire—are of various patterns. In most places they are of cast-iron, cast in 3-foot lengths. Sometimes the plates are bolted down to stone blocks, at other times they are fixed with thin metal keys into tiny chairs. In one place I came upon a 15-foot wrought-iron rail, evidently a later addition. I also noticed, what I have never seen described in any of the old books, the arrangement made to enable ordinary vehicles to cross the flange of the plate-rail, which, as a rule, stood up 3 inches or so above the road level. At one point, where a bye-road fell in, the rails became troughs, so to speak, for they had flanges on each side of the plate instead of on the inside only, and in addition, their upper edges, instead of being left plain, were cut out in a kind of scollop, evidently lest a carriage wheel should catch as it passed obliquely over them.

It is rather remarkable in these closing years of the nineteenth century to be assured that Milford Haven is the port of the future. To say nothing of recollections of its earlier history, when the second Henry sailed thence to assume the lordship of Ireland, and the seventh Henry landed there to

* Of the history of this piece of line I must regretfully confess myself ignorant, but we may safely assume that it was a branch of the Cardiff and Merthyr Tramroad, which was constructed under an Act of Parliament as long ago as 1794, said to be the first Railway Act ever obtained, and on which Trevithick tried his first *railway* engine, in February, 1804. On that occasion, according to Mr. Smiles, "the engine succeeded in dragging after it several waggons containing ten tons of bar iron at the rate of about five miles an hour."

claim the Crown of England, a visit to the place to-day might rather lead us to characterise it as the port of the past. That Milford Haven is a magnificent piece of water, in which—to apply the standard gauge of harbour magnificence—all the navies of the world could ride at anchor in safety; that vessels can enter and leave it at all times and in any state of the tide; and that it might be brought within seven hours' journey of London, are all postulates whose truth may be granted without discussion. But so long as water carriage remains cheaper than land carriage it is difficult to conceive that Milford can rival Cardiff or Bristol as a commercial port.

As for the fleet passenger steamers which, we are told, will carry travellers across the Atlantic in four days—will steam, that is, fully half as fast again as the 'Etruria' and the 'Umbria'—such a scheme will probably have to wait not only till steamers can afford to dispense with cargo, but till London and the South of England can supply a sufficient number of passengers to fill the whole boat, as it can hardly be claimed that for Glasgow or Yorkshire, Milford will be as convenient a landing-place as Liverpool. Meanwhile, the project has at length been brought at least within the bounds of possibility. After fourteen years, during which the work has several times been suspended, and has more than once appeared on the eve of abandonment, the docks—and very fine docks they are—have really got so far towards completion that the water has been admitted into them. If the solitary engine, that with its three passenger coaches and an occasional goods truck climbs laboriously seven or eight times a day up the four steep miles of single line to Johnston Junction, has hitherto sufficed to cope with all the requirements of the traffic, we must hope that ere long there may be another tale to tell; for the unfortunate inhabitants of the place, who fourteen years ago were deprived, by the commencement of building operations, of their local harbour, and have scarcely even yet got a new dock in its stead, deserve some compensa-

tion for the hard fate that through no fault of their own overtook them.

There is, however, a very considerable traffic between Ireland and Milford Haven. But it does not pass through Old Milford where the docks are, but through Neyland some five miles further up the Haven, or, as it has pleased the Railway Company to christen the place, New Milford. From here there are steamers every day to Waterford, and every other day to Cork: but the remarkable thing about the place is its fish, and especially mackerel traffic. The fish are caught in the spring and early summer off the Irish coast; taken by the smacks into Berehaven or Kinsale or some other of the Irish harbours; there they are bought by the dealers' agents, packed in ice, and transferred to steam carriers, which make off at once at full speed for Milford. From Milford they are distributed all over the country by the salesmen, who employ the telegraph in their transactions with a freedom that one naturally associates with Tattersall's or the Stock Exchange, rather than with philanthropic efforts to supply the poor with a nutritious article of food at a moderate cost. But then it must be admitted that mackerel are not like ducks, which come to be killed for the asking. Here is a list of the weight in tons landed at Milford for seven successive days in one week last spring—634, 596, 351, 27, 45, 14, 436. Six hundred tons of fish sounds a large quantity, but it is by no means exceptional. On one occasion a dozen train-loads were despatched in the course of the day.

It is impossible to conclude these notes on the Great Western Railway without saying something of the Severn Tunnel. There is no need for me to attempt to tell the tale of its construction; it has been told too recently by the man of all others best qualified for the task; but the dogged determination of the Company and its chairman that the tunnel should be made, the dauntless energy and inexhaustible resource of the contractor, and the heroic pluck of the divers and navvies who boldly faced the fierce rush of

subterranean rivers, combine to form a chapter in engineering history of which Englishmen have a right to be proud.* To show the magnitude of the task, it may be mentioned that Sir Francis Head, himself an engineer by profession, writing less than forty years ago, deemed it necessary to accentuate with italics and notes of exclamation the marvellous fact that, during the construction of the Kilsby Tunnel, "by the main strength of 1250 men, 200 horses, and 13 steam-engines, . . . the astonishing and almost incredible quantity of 1800 gallons of water per minute was raised from the quicksand and conducted away." At the Severn Tunnel, now that the springs have been finally beaten and pumping has been reduced to its normal amount, about 10,000 gallons per minute are being raised from a considerably greater depth. One single pump with buckets over two feet in diameter lifts every 8 seconds, and will lift every 5½ seconds if run to the full power of the engine, 490 gallons of water from a depth of 250 feet. Not long since, a workman was sitting on the side of the open culvert into which this pump discharges. Just as the huge beam, with its 40 tons' weight of gearing attached, reached the top of its stroke, he slipped over the edge; the water surged up, and in an instant he was carried riding on the crest of the wave right out into the river. On the whole, the 16 pumps are lifting over 500 million gallons per month, or enough to supply a town the size of Liverpool, and burning 1000 tons of coal in doing so. It is at present in contemplation to use the power of this water as it runs down to the river to drive electric machinery to light the tunnel.

Another point in which we have improved upon our fathers may be noted. A Kilsby navvy, being asked if he ever went to church, replied, drawing his metaphor from his daily avocations: "Soonday hasn't cropped out here yet." At Sudbrook, above the great spring, there was a wooden

* It is to be hoped that before long Mr. Walker will publish in cheap form, with the technical details and elaborate drawings omitted, an abridgment of his *History of the Severn Tunnel.*

chapel for the use of the workmen. This building took fire and was burnt to the ground. Within three weeks—the bricklayers working night and day, and fires being kept constantly alight to dry the walls—a solid brick edifice with seats for 600 people had taken its place. The pumps are not the only machinery constantly at work. There is a huge fan that exhausts 220,000 cubic feet of air every minute, and keeps the tunnel so clear of smoke and steam, that the platelayers say that at midday, from the bottom of the incline in the centre of the tunnel, they can see the sun shining on the metals at the mouth two miles and a half away.

An interesting book might be written by anyone who had the requisite topographical knowledge to trace the manner in which the railways of England follow the lines, not only of the old coach roads, but of the earlier routes that preceded them. A mile above the Severn Tunnel is Aust, where, on what was then the English frontier, St. Augustine met in conference with the Welsh bishops. Here, too, was the Old Passage where the coaches from Bristol to South Wales were ferried across, and old inhabitants can still remember how one stormy day the Severn came down in flood, and swept coach and passengers and ferry-boat out to sea. Just below is the New Passage, where, though steam had replaced both horses and ferryman, one was still exposed a couple of years back to all the discomforts of a Channel passage in a scarcely mitigated form.

The working of the tunnel traffic, which is advancing by leaps and bounds, is giving occasion for more than one ingenious development of electric science. Among them may be mentioned a wire carried through the tunnel, which, if cut by the guard's knife in case of break-down, sets bells ringing in the signal cabins at either end, and gives warning that the lines are blocked. Another thing is a bell at the bottom of the incline to give timely notice to drivers and guards to release their brakes, lest the sudden jerk should snap the couplings. The bell is to be set ringing from the signal-box as the train enters, and silenced by the train

pressing down a treadle as it passes it. By a further refinement, a portion of the current is diverted through a small indicator bell in the signal-cabin, that the signalman may be sure that all is working correctly. But it is expected that before long the growth of the traffic will compel the division of the tunnel into two sections, and the erection of a signal-cabin in the middle. In that case we fear the men will find that the punkah constantly at work over their heads renders the climate anything but tropical.

What the ultimate consequences of the opening of this great highway may be, it is as yet too soon to speak. Southampton and Portsmouth are already beginning to draw their steam-coal by land instead of by water. That ships trading to Bristol will load in Bristol docks with a return cargo of South Wales coal, is among the possibilities of the immediate future. Even now the travellers of Bristol houses are taking, in the mining centres of Monmouthshire and Glamorgan, orders that formerly went to the Cardiff shopkeepers. And it is not too much to say that the passenger services between the West and North of England have been simply revolutionised already. In June last a passenger leaving Bristol at 9.5 in the morning reached Edinburgh, by changing at Birmingham to the North Western, at 8 P.M. If he continued by the Midland line throughout, he got there at 8.42. To Glasgow the times were 8 and 8.55 P.M. respectively. Since the 1st of November he can leave by the Midland at 9.35, and reach Edinburgh at 8.24. But by the new Great Western and North Western joint service *viâ* the Tunnel, Hereford, Shrewsbury, and Crewe, he leaves only five minutes earlier, and is in Edinburgh at 6.30. Four hundred miles in nine hours is not bad travelling for a cross-country service. To Glasgow the times are: Midland, 7.50, and North Western, 7 P.M.* To Liverpool the gain is even greater, proportionally.

* December brings a fresh alteration. The Bristol train still arrives at Crewe in time to catch the 10 o'clock express; the through carriage, however, is not attached to this train, but remains at Crewe 20 minutes, going forward at 1.35 and reaching both Edinburgh and Glasgow at 7.30.

From Cardiff to Liverpool was a long day's journey last spring; the quickest road was round by Gloucester and Birmingham. Now there are three services each way daily, averaging about five hours. Nor is this all that the public has gained by the innovation; for the new competition has compelled the Midland, which already was running the best cross-country expresses in England, to smarten up enormously its whole Bristol service; and from Bristol to Leeds and Bradford, to say nothing of the branches from Derby to Liverpool and Manchester, and from Sheffield to Hull and Newcastle, the Midland serves a town population of at least two millions. Sleeping carriages, moreover, are now run on both roads both to Glasgow and to Liverpool.*

It is difficult to avoid contrasting the success of the Severn Tunnel with the lamentable failure—from a commercial point of view, at least—of the scarcely less remarkable tunnel carried under the Mersey at the most northern extremity of the Great Western territory. No doubt in some respects the Mersey Tunnel lies under serious natural disadvantages. The necessity of going 150 feet below the bed of the river in the centre, and yet of coming up within reasonable distance of the surface close to the banks in the heart of the two towns has implied gradients of 1 in 27 and 1 in 30, against 1 in 90 and 1 in 100 on the Severn, where it was possible to put the mouth of the tunnel a mile back from the river-bank

* Let me note two points. These new Severn Tunnel services cannot well start from Exeter, as the expresses with which they connect are broad-gauge; still less can they start from Plymouth, where the gauge is broad only, but they might—or at least some of them might—start from Weymouth or Salisbury. The services on that part of its system at present are certainly not a credit to the Great Western, still less so when compared to the admirable connections over the Somerset and Dorset to Bournemouth. Let one instance suffice. To catch the 9.30 A.M. from Bristol, it is necessary to leave Weymouth at 5.20 A.M., Salisbury (53 miles off) at 6.5, and even Trowbridge (24¼ miles off) at 7.20. My other point is to express a hope that the Severn Tunnel service may be the forerunner of others as creditable. Cheltenham, *viâ* Oxford, Bletchley, and Bedford, to Cambridge, is a through route ready made. Crewe, *viâ* the North Stafford and Derby, to Nottingham and Lincoln, is another that should not be beyond the bounds of possibility.

on either side. And gradients of 1 in 27 are certainly not suited for the economical working of goods traffic, though even up these steep inclines the splendid engines that Messrs. Beyer and Peacock have built for the work can take a load of 150 tons at a fairly round pace. Nor can a tunnel, 2¼ miles without a break, expect a passenger traffic equal in amount to that on our Metropolitan railways, where people can get in and out at two or three different points in every mile. For all that Londoners would have reason to congratulate themselves if their "Underground" were supplied with the admirable system of lifts and the splendid method of ventilation that have been adopted by the enterprise of the unfortunate Mersey shareholders. So perfect is the suction of the exhaust-fans that it is sufficient to blow a pocket-handkerchief, held by a man walking fast down the inclined approaches to the platforms, straight out in front of him; and at times almost sufficient to cause him to walk much faster than he is naturally disposed to. The pumps, too, though they have not the reserve power of the giants at the Severn Tunnel, are actually lifting very nearly an equal quantity of water.

Every tale should have a moral, and the moral of the failure of the Mersey Tunnel and the success of the Severn Tunnel, though it is twice as long and has been twice as costly, is, I think, an obvious one. It is the same moral that is enforced by the commercial failure of the Hull and Barnsley, the Eastern and Midlands,* the Didcot and Newbury, and half a dozen other small undertakings that have similarly fallen short of the sanguine hopes of their promoters. The moral may be put in the form of the old proverb, which warns us of the fate which attends earthen pots that swim down stream alongside of pots of a less frail material—in other words, a small independent company has no chance, in competing for through traffic, with one of the great railways, even though its line may, geographically

* [Now the joint property of the Great Northern and the Midland. 1899.]

speaking, be the most advantageous. A few miles above the Severn Tunnel is, and has been for years past, a Severn Bridge. The bridge is almost empty,* the tunnel is already crowded. So long as it was necessary to pay toll to a "foreign" company, the Great Western preferred to send their traffic round by Gloucester, spite of extra distance and heavy gradients. Now that the shortest route belongs to themselves it is another matter. In the same way, looking at the map, we might think that the natural route from Bristol to Liverpool was not to strike east to Crewe, but to continue on *viâ* Wrexham and Chester to Birkenhead, and thence through the Mersey Tunnel, with which the Great Western already has a physical connection. But to do this would mortally offend the powerful North Western, and the North Western might retaliate all along the line from Warrington to Carmarthen.

There is, however, one hope for the Mersey Company. The Great Western is prosperous and pacific; the Manchester, Sheffield, and Lincolnshire is not only poor and struggling, but is animated with a migratory instinct similar to that which is driving forward the Metropolitan Railway —away from the sulphurous tunnels of Baker Street; away from the suburban amenities of Harrow; past the primitive rusticities of Chesham and Chenies; and on to the milk and honey of the Vale of Aylesbury. Most people know that the Sheffield Company are engaged at present in bridging the Dee below Chester, and forming a connection across the lands of Hawarden with the rich mineral districts of Flintshire, and the Wrexham, Mold, and Connah's Quay Railway, that already partly serves them. A junction in Liverpool with the Cheshire lines just outside the Central Station, and the construction of a short new line from the Dee Bridge to the Mersey across the Wirral Peninsula, will probably be made before long, and, when made, may possibly place the

* [The bridge has now been bought by the Great Western and the Midland jointly, and needless to say there is plenty of traffic for it. 1899.

Mersey Tunnel in a position very different from that which it occupies at present.

As I write, the Parliamentary notices have just been lodged for a vast scheme of amalgamation, which might ultimately embrace not only the Sheffield, the Mersey, and the Wrexham, Mold and Connah's Quay, but all the unattached Welsh lines as well; to say nothing of further possibilities of extension northwards to Preston and Carlisle. If this were ever to come to pass, we may safely assume that the old story of captive Greece leading captive her conqueror would be told once more. The wrongs that gallant little Wales endured in the sixth century A.D. would be avenged at last; the new Great Cambrian would invade England *viâ* the Golden Valley and the Severn Bridge; and pushing boldly in between the Saxon outposts at Bristol and Birmingham, would descend through the passes of the Cotswolds into the valley of the Thames, and not content with the capture of Lechlade and Witney and Oxford, strike direct at the Metropolis itself.

No one ever need despair of the fate of an English railway. Twenty years since, Great Western stock might have been bought for 38. This winter it has been quoted at well over 150. But no one who knows the line and its capacities for development can think that the rise has yet reached its limit.*

* [Alas for the poor Mersey Tunnel! Though the Wirral line is made and the Dee Bridge finished, the Severn Bridge has passed into other hands; the Golden Valley line is derelict; the Sheffield Company has found the task of extending its line to London almost more than enough to absorb its whole strength, and has had neither time nor money to spare for Wales; and the Mersey Tunnel is more hopelessly bankrupt than ever. 1899.]

CHAPTER VII.

THE SOUTH WESTERN RAILWAY.

The South Western Railway forms a fit transition between the great northern and western trunk lines, and what, if one were to insist on an arboreal metaphor, might be called the shrubby lines to the south and east. In one sense, of course, every company has a main line. Even the Metropolitan has one, and it extends from Aldgate to Edgware Road. But the main line of the Brighton Company, for instance, is hidden amidst the labyrinth of branches, many of which start away from the very roots of the central stem, crossing and recrossing and interlacing in almost inextricable confusion; and the mere appearance of the map entirely fails to show that any one road is more important than the rest. Now, if it cannot be said that the original main line from London to Southampton, extended as it has been on to Dorchester and Portland, is an inconspicuous stem, still less that the branch to Exeter, Ilfracombe, Bodmin, and Plymouth is anything but a vigorous offshoot, for all that it is strictly true that the through traffic is by no means so important a part of the South Western business as it is in the case of the northern lines. Compare an express to Birmingham with an express to Portsmouth, the largest town on the South Western system. The Birmingham train drops perhaps half a dozen passengers at Northampton, and a few more at Coventry, possibly leaves behind at Rugby a carriage for Leamington; but the great bulk of the passengers go through all the way.* Suppose, on the other hand, that

* The Irish mails on the North Western only carry passengers for Chester and Holyhead, the Scotch expresses—in summer at least—only for Carlisle and stations beyond.

a train earns an average of £30 on the 74 miles between London and Portsmouth. Not more than £8 or thereabouts of this will be through fares, the rest will be paid by passengers who get in or alight, or both get in and alight, at intermediate stations. While therefore the exacting demands of the British public—not unassisted, perhaps, in the case of Exeter and stations beyond by the competition of the Great Western—succeed in obtaining from the South Western trains that can a good deal more than hold their own with the 'Lightning' and 'Cannon Ball' expresses of France and America, it would be vain to look here for speed such as is to be found on the great through routes to the north.*

The great bulk of the South Western traffic being then local and residential—much of it of a suburban or semi-suburban character—it is in London itself and its neighbourhood that the special interest of the line centres. And what is more, compared to the passenger traffic, the goods traffic on the South Western, as on all the southern lines, is a very secondary matter, that may without hesitation be passed over in silence in the following pages. The South Western carries in a twelvemonth about thirty-five million passengers, as many as are conveyed by the Midland, more than travel by the North Eastern (each of which has nearly twice the mileage), and almost half as many again as use the Great Northern. But when we come to goods and minerals, the South Western has about three million and a half tons, as against nine and a half credited to the Great Northern, twenty-five million to the Midland, and very nearly forty to that giant among the coal lines—the North Eastern.

* The 2.40 to Exeter, which covers the 171¼ miles in 4 hours and 2 minutes—why those odd 2 minutes?—and the 12.30 to Bournemouth, 107 miles in 2 hours 29 minutes—as fast as the best train to Birmingham—may fairly claim to be quite in the first flight for the south of England. Truth, however, compels me to add that the practice of this latter express has not always squared with the theory of its time-table. [The Exeter timing is improved to 3 hours 45 minutes, and the Bournemouth to 2 hours 5 minutes. 1899.]

This state of things, however, is very different from that which was contemplated by the projectors of the original London and Southampton Railway. In the estimate officially put forward by the promoters, it was calculated that the passenger traffic would be worth £50,000 a year, while coal would bring in £40,000, goods and parcels to and from intermediate stations £21,000, and imported goods from Southampton £70,000, of which no less than £20,000 was to be contributed by the single item of "foreign fruits." Opponents of the line declared that even this modest estimate was absurdly too sanguine; one of them went so far as to assert that the railway would only be used for the conveyance of "parsons and prawns—the one from Winchester, the other from Southampton." They could hardly assert, however, that the Chairman's estimate of the rolling stock required—two engines for passengers and three for goods, at a cost of £500 apiece; or of land—84 acres for all the stations, goods yards, and warehouses on 76 miles of road—erred on the side of extravagance. As a matter of fact each engine cost £1500, and within four years of opening the line there were forty-nine of them in use; and the land cost £300,000, instead of £65,000.

But the Company were hardly more out in their reckoning than a gentleman who had contracted to buy an estate at Wimbledon. After the contract of sale had been duly signed, Parliament consented to pass the South Western Bill, which authorised a station at Wandsworth and a second at Wimbledon. On receipt of this fatal news, the purchaser appealed to the generosity of the vendor to forego a portion of the price, in consideration of the injury that must be done to the property; and, what is more, his request was granted.

At a very early period of its history, the South Western was confronted with a difficulty that has never yet been satisfactorily disposed of, though it is not nowadays the burning question that it was forty or fifty years since—

what accommodation it should afford for travelling on Sunday. In 1839 the Directors received a memorial from the clergy of the diocese of Winchester, complaining that "the systematic desecration of the Lord's Day is openly sanctioned," and protesting against the practice as "tending to corrupt public morals." The memorialists appeared to imply, though they did not say so in so many words, that they objected to any trains at all being run. And it was on this supposition that the Chairman of the Company framed his reply. After pointing out that the Company was "by Act of Parliament compelled to run trains on the railway on Sunday for the convenience of the Post-office," he went on to say that it was "manifest that travelling by railroads greatly reduced the animal labour employed on the public roads, and consequently reduced the quantity of human labour required for conducting the employment of horses." He continued in these words: "If any body of proprietors assumed to themselves the right of stopping the public and cheap means of travelling on the railways, now that the other public conveyances have been removed, it would subject them to the imputation of obstructing the necessary and reasonable movements of those who cannot provide private carriages even for purposes of necessity. We further submit to you that the whole question of Sunday travelling is one that justly and properly belongs to the Legislature of the kingdom to determine, and ought not to depend on the caprice of railway companies." The clergy do not appear to have pressed their contention any further.

Two or three years later, however, the same question was raised in Scotland, and, as might have been expected, in a much more uncompromising manner. Soon after the opening of the Edinburgh and Glasgow line, a committee "for opposing Sabbath travelling on the railway" was formed, and carried on an active propaganda. The kirk session of one of the leading Edinburgh churches recorded their solemn resolution "to accept of no remuneration, however large, for the passing of the extended railway through their churchyard,

unless absolute security can be given against railway travelling on the Lord's Day," and called upon their fellow-citizens to support their action. It was pointed out at the time that this resolution was somewhat hazardous, as the only result would be (supposing a Sabbath-desecrating railway to succeed in obtaining compulsory powers from Parliament) to oblige the kirk session to present it with valuable land gratis. Some time after this, the committee came to present their accounts to the public, and not a little surprise was expressed when it was found that out of a subscription list of £211 12*s.* 4*d.*, no less than £112 was charged as expenses "attending means used to encourage other modes of conveyance between Edinburgh and Glasgow."

But from that day to this, Scotland has remained almost absolutely without railway communication on a Sunday. Except for the night mails to and from London, and one train between Glasgow and Greenock by each road—these latter only put on, and not without strenuous opposition, a year or two back—it may practically be said that (outside North British territory, in which matters are somewhat better) there are no Sunday trains in Scotland at all. In England, on the other hand, the tendency at present is undeniably towards the increase and improvement of existing services. The South Western itself, for instance, has been running all through the summer a fast new train between London and Bournemouth. There are, however, few questions that come before railway managers for decision more difficult than this of Sunday trains.

Passengers never complain from Monday to Saturday that trains are too numerous; but in reference to Sunday services in addition to the ordinary question—in itself a sufficiently involved one—whether a new train will pay or not, the railway management is between the two fires of the public who demand more accommodation, and the public who protest against any concessions being made at all. No wonder our Sunday services are as a rule unsatisfactory. Mr. Foxwell once explained the fact by imputing to railway managers belief in a theory "that Providence, though disapproving of railway

services on the Sabbath, may yet be mollified if those trains are worked so as to be of as little use to the passengers as possible." Perhaps we might rather explain the multitude of trains that start about 6.30 to 7.30 on a Sunday morning by a desire to get them safely to their destination and out of sight before anybody not aroused by urgent necessity had left his bed. Some such hypothesis certainly seems necessary to account for a line so sweetly reasonable in ordinary life as the Great Northern starting a train from Cambridge to London at 7.15 A.M., and then not another till 5.40 P.M.

There is one objection, and a very proper one, often brought against proposals to improve Sunday services, that the men have a right to a day of rest. Fortunately, however, the two objects are by no means incompatible. It is reported that the General Manager of one of our great lines has informed his board, not only that he will undertake to add a quarter per cent. to the shareholders' dividend, but to guarantee every man on the line one day entirely free in each week, if he may run a proper Sunday service. How he would be able to do so is obvious. The present number of trains is sufficient to cut a man's Sunday up and render it almost useless, but not sufficient to justify the extra expense of engaging a relief-staff. But the fact that we hear so little nowadays of this formerly burning question may be taken as a proof of the care with which our railway companies watch, and also no doubt themselves represent, the average level of public opinion on the subject.

The first terminus of the South Western was at Nine Elms, somewhat further west than the Vauxhall Station of to-day. The site of it was described at the time as "low and marshy, studded with windmills and pollard trees, and Dutch-like in appearance." Ten years later the line was extended to Waterloo, at a cost of £900,000. The original station is so embedded in the various extensions and additions that have accumulated round it, that it is not very easy to trace it to-day. But it may roughly be said to

comprise what is now the main line station, though the platforms have been lengthened considerably in both directions. It was built on ground "formerly occupied by hay-stalls, cow-yards, dung-heaps, and similar nuisances." "We have placed on the railway," said the Chairman at the annual meeting, "between Nine Elms and Waterloo, four distinct lines of rails, in order that we may have no trouble or inconvenience in future in the traffic; and also that, whatever may be the adventurous schemes of the age in future, whatever may be the probability of introducing lines south of

WATERLOO STATION AND ENGINE HOUSE. 1848.

London, we may not only have ample means of conducting our traffic, be it what it may, but of ability to let others come and hire, that we may benefit by their enterprise and industry on our property."

These brave words were spoken in 1848. Within a very short time the growth of the traffic compelled the erection of what is commonly known as the Windsor Station. The year 1879 saw the addition of the South Station, with two more platforms, Nos. 13 and 14. The South Station is known to the staff as "Cyprus," because it was opened just at the time when Lord Beaconsfield returned from Berlin, bringing "peace with honour." The relief, however, only sufficed for

six years. In 1885, a new North Station, christened on a similar principle "Khartoum," and with platforms numbered from 15 to 19, was opened; and now, though it certainly cannot be said to be one of the most convenient, the South Western Company can at least boast that they own the largest railway terminus in London. Such as it is, however, it is probable that Company and public will both have henceforward to make the best of it To recast so huge a structure, with 100,000 passengers, and 700 trains in and out every day of the year, is a simple impossibility; a task that, unless the population of London all take holiday for a twelvemonth, is hardly likely to be so much as attempted.*

As for the four lines of rails that to all time were to afford the most ample "means for conducting the traffic, be it what it may," they have long been recognised as completely insufficient. A third pair of rails, making six in all, is now on the eve of completion; but the Company, who have had to pay enormous sums for the property they have expropriated for their new widening, have had reason to wish, as one piece of land after another has been conveyed to them with the title-deeds reciting that it was sold to the present vendors or their predecessors in title by the Company itself less than forty years ago, that their Chairman had really been as far-seeing as he fancied himself.

To obtain accurate figures of the growth of the traffic is not very easy, but the following, as far as they go, may be taken as trustworthy. Twenty-five years ago, the signalmen at Clapham Junction, when applying for an increase of pay, and when therefore they were not likely to understate their

* [A large scheme of extension has just been sanctioned by Parliament, and Waterloo is to become ere long half as large again. But it is becoming increasingly evident every year that the impossibility of recasting will have to be faced. Otherwise mere increase of space will hardly solve the perplexities of the traffic staff on the one hand and of the public on the other caused by the heterogeneous collection of platforms which at present has to do duty as a station. But as the 700 trains of 1888 have grown to nearly 1000, the task of reconstruction will be perhaps the hardest ever imposed upon a railway company. 1899.]

case, asserted that 325 South Western trains passed through that station every twenty-four hours. On Derby Day, 1867, the number in and out of Waterloo was 480; but that included no less than 125 specials. In 1878, on an ordinary day in November there were 471 trains; in 1881 the number had increased to 556; seven years more has brought it to over 700. And the increase in the length and weight of each train has meanwhile at least kept pace with their increase in number.

Waterloo was not intended to be the Company's final goal. Had the financial crisis of 1848 not intervened, the South Western would have been continued on into the City. Much of the land had already been purchased. The site on which stands Barclay and Perkins' brewery, the lineal successor of that which Dr. Johnson sold along with "the potentiality of growing rich beyond the dreams of avarice," was already in hand. The directors were in treaty for the acquisition of Southwark Bridge. But when the crash came, the whole scheme was hurriedly abandoned. Nor was this all. The projected line from Salisbury to Exeter, a Bill for which had been obtained as almost the sole result of a Parliamentary struggle that cost the shareholders the appalling sum of £400,000, was abandoned at the same time. The portion of the line from Salisbury to Yeovil was constructed some ten years after by a separate company, whose pluck and enterprise were rewarded with annual dividends of fourteen per cent., till the concern was finally re-absorbed into the South Western not many years ago.

One small piece of jetsam that was not swallowed up in the storm of 1848 deserves a word of mention to itself. The Bodmin and Wadebridge Railway obtained its Act when the Liverpool and Manchester was a promising two-year-old. It was opened for traffic in 1834, the year in which Parliament sanctioned the construction of the London and Birmingham, and the year before the promoters of "a line called the Great Western" succeeded in overcoming the resistance of the Lords to their new-fangled schemes. Like all its

predecessors, it was intended for the conveyance not of passengers but of goods. Not in this case, however, cotton or coal, but sand from the estuary of the Camel to fertilise the rich pastures round Bodmin and Wenford. The Act, which extended over seventy-six folio pages, authorised the construction of a railway 14¾ miles in length, with a capital of £35,000; and, remarkable to relate, the line actually was opened for traffic with £106 8*s.* 5*d.* of its capital still unspent. There are probably not many other railways in England that got to work at an original cost of only £2300 a mile. But then it must be admitted that the directors exercised a strict if not even a penurious economy. In the statement of expenditure submitted to a meeting of the shareholders in May, 1834, when the line was on the eve of completion, there stands this item:—"Steam-engines, comprising engines, waggons, engine-house, forge, coal-sheds, weir and iron pipes for the supply of water to engine, tank, pumps, &c. £25 8*s.* 10*d.*" With an economy such as this, even the most exacting criticism must surely have been satisfied.

In 1845, when "the battle of the gauges" was raging, both the Great Western and the South Western cast longing eyes upon this small Naboth's vineyard. It is true that by no possibility could the line, which ran north-west and south-east, ever form a portion of a through route. It is true too that neither Company had as yet approached within a hundred miles of Bodmin; but such considerations matter little to combatants when their blood is up. The Great Western offered to buy the Bodmin and Wadebridge, spite of the fact that it was paying no dividend, at a large advance on the cost of construction, provided only they got their Bill. The South Western did not, in one sense, offer quite such liberal terms, but they undertook to purchase, whether or no; and with this latter offer the Bodmin directors closed. From that day to this the South Western has owned this small line that has never had any connection with the rest of its system, and it is safe to say that it has had no special reason to congratulate itself on its purchase. The strangest

part of the whole story perhaps is that it was not till a year or two back that Parliamentary sanction was obtained to the bargain concluded in 1845.

Recently the portion of the line between Wadebridge to Bodmin, whose archæological interest was quite disproportionate to its commercial importance, has been subjected to a process of modernisation which has practically implied reconstruction. The branch to Wenford, however, has fortunately remained untouched, and on it may still be seen the original rails resting on "chairs," no larger than a man's hand and weighing 8 lbs. apiece, as against the 40 or 50 lbs. of a modern chair. The stone blocks to which, in lieu of sleepers, the chairs are fastened down by two long tenpenny nails, are of all sorts of shapes and sizes, though roughly they may be averaged at 2 feet across at the top, and a foot in thickness. But the rest of the line has at length, by the opening of a new branch from Bodmin Road on the main Great Western line to Bodmin, been brought into connection with the railway system of the country.* When I was there last spring matters were in a transition stage. The old line was in the hands of a contractor, and was rapidly being brought up to modern requirements. The passenger service had ceased to run; the train which left Wadebridge on Mondays, Wednesdays, and Fridays, and returned from Bodmin on Tuesdays, Thursdays, and Saturdays, had been taken off; and the whole of the rolling stock, consisting of one first and second-class composite and two open third-class trucks of the *char-à-banc* description, was standing idle in the carriage shed.

To show the difference between the old and the new style, it may be mentioned that the width of the track to accommodate the single line of 4 feet 8½ gauge was originally 9 feet, and is now 17, and that, whereas the old stone blocks rested on the bare ground, and the wooden sleepers which

* [Connection with the South Western system has also been recently made by the extension of the North Cornwall line from Launceston to Wadebridge. 1899.]

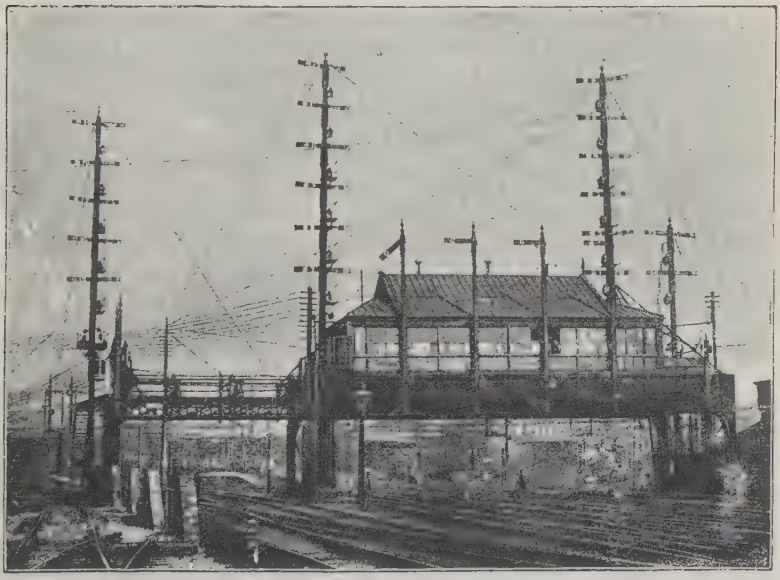
were introduced at a later period rested directly on them, the new line runs on the top of a bed of ballast carefully packed and levelled, and nowhere less than 2 feet in thickness. Moreover, though the original company built 15 miles for £35,000, it is understood that it has cost the Great Western about half as much again to construct the link, four miles in length, which stretches from Bodmin to Bodmin Road.*

There is no need of the force of contrast to heighten the feeling of astonishment with which one watches the working of the traffic in and out of Waterloo Station. At the busy times of the day, say from 8 to 11 A.M., and from 2 to 6 P.M., three trains arrive and depart every four minutes. Scattered about over the yard are several auxiliary signal-boxes, but the key to the whole situation is the "A" box, which stands astride of the "running lines," as they are termed, in and out of the station. From this box the points and signals throughout the yard are worked by 209 different levers, which make in the course of the twelvemonth (so the men themselves have calculated) the satisfactory total of 5,222,600 movements, or an average of twenty-two movements for each train. To this box there are attached, not counting a swarm of boys who run messages and make entries in the train books, ten signalmen. Four are on duty from 7 A.M. to 2 P.M.; four more from 2 to 10 P.M., while from 10 o'clock at night till 7 the next morning two men are sufficient to cope with the diminished traffic. But though the hours are short, the work is no sinecure. Probably the mental strain, the haunting sense of responsibility, that to an outsider seems so crushing, does not affect the signalmen very seriously. They have gradually been broken in to their task, and perform their functions in a cool matter-of-fact manner, concerned to

* At Waterloo not many months since I saw some relics of this old line in its original state. Two or three rusty old iron rails, not much thicker than a man's wrist, with still rustier chairs fixed on stone blocks, and some primitive points and crossings and switches, had been sent up to London as antiquarian curiosities. They were lying, as though to heighten their effect, on a spick and span new carriage truck with continuous brake-pipe and all modern improvements

remember that lever 49 must be pulled over before and not after lever 167, rather than to think what might be the possible consequences of an inversion of the order.

Besides, thanks to the perfection to which block-signalling and interlocking have been brought nowadays, though it is easy enough to delay a train, it needs considerable ingenuity to organise an accident. But the physical labour involved is



THE OLD "A" BOX AT WATERLOO.

considerable. To say that 900 to 1000 levers are worked per hour, means in other words that each man has to move a lever every fifteen seconds, and the pull is a heavy one even to a strong man. Anyone standing in the box about 6 o'clock in the evening, and listening to the incessant ting-ting of the electric bells and the crash of the levers, as they are thrown hastily over, and the catch springs back and locks them securely in their new position, can imagine that the men are thankful when the rush gradually begins to

subside, and they can get a moment's rest to eat their suppers.

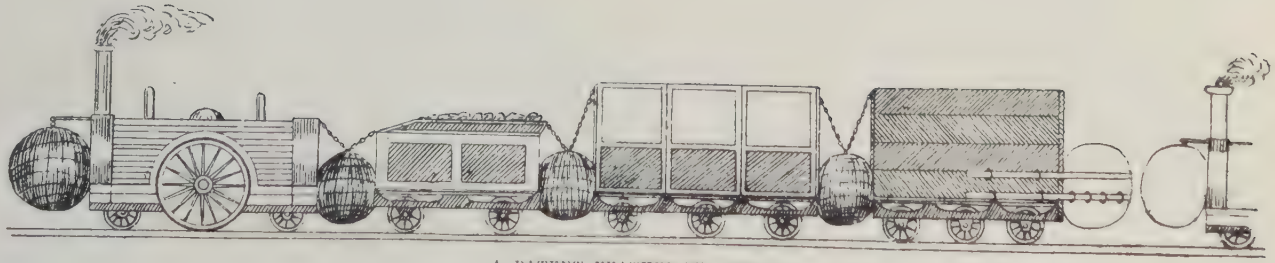
Few men deserve the sympathy of their fellow-countrymen better than the class of railway signalmen. Porters and guards are in contact with the public, and in many places their wages are by no means the largest part of their actual earnings. Even engine-drivers sometimes come in for an occasional tip, while in any case their wages—ninepence an hour as a rule after a few years' service—are calculated on a scale more liberal than is paid to any other class of workmen who are not skilled artisans, and have not been obliged to serve an apprenticeship. But with the signalman, as far at least as the public is concerned, out of sight is out of mind. He works long hours at his anxious occupation for wages that are only moderate in amount. A single slip—one error after a million movements accurately performed—may bring about an accident, and lead to his dismissal from his post, leaving him of course unable to obtain employment from any other company at the only trade he knows, and to a great extent unfitted by the life he has led for ordinary outdoor occupations. At best he cannot hope that his nerves will suffer him to continue in his box much after what in the upper classes would be called middle-life. I am far from wishing to suggest that the great lines treat their men badly. Undoubtedly the wages they pay are sufficient not only to attract but to keep good servants. But if every railway company in England were to establish a signalmen's superannuation fund, and to maintain it with only a trifling deduction from the men's pay on account of it, I cannot think that many shareholders would be found to grudge the outlay.

By the time these pages see the light the "A" box will have almost lived out its appointed length of days. A new and larger box, to control the new six instead of the old four roads, is now in process of construction alongside it, and has already made considerable progress towards completion. It is worth notice, as a specimen of the pains railway companies

take, and the expense they incur to avoid risk to their passengers, that though levers and locking-frames with all their elaborate mechanism are not to be bought for nothing, the old box is being left untouched till the new is fully ready for use. To transfer the fittings from the one to the other would mean hand-signalling the trains into Waterloo for a week or two. Even as it is, the permanent way and the signal departments are likely to have one or two lively Sundays in the course of the spring.

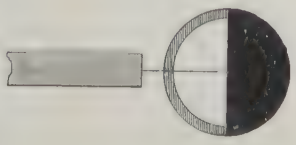
Perhaps the most remarkable point in connection with the system of signalling is to realise that the whole of it is the growth of little more than one generation. Indeed its more elaborate developments are only half that age. The inspector who now has charge of the whole working of the station at Waterloo was stationed at Clapham Junction twenty-five years ago. In those days the trains were all controlled by disc signals worked from a box on the platform itself, and unassisted by bell or message from the stations on either side. But there is one among the signalmen at Waterloo whose memory goes back to the dark ages when signals as yet were not, and when, in their absence, a journey was so perilous, that one ingenious projector desired to insert feather-beds between the carriages in lieu of buffers, and to suspend a bed of extra proportions in front and at the tail of each train, while a second urged that the engine ought always to be from a mile to a mile and a half in advance of the train, connected to it by a sufficiently strong rope. "In case of an accident," as he feelingly observes, "the engineer only would be imperilled."

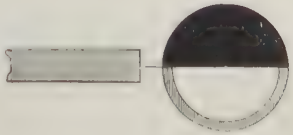
Up under the roof of the main line platform at Waterloo, in a small box wedged tight against the gable end, where probably not one passenger in five thousand has ever noticed it, and appropriately named the "Crow's Nest," there sits for eight or nine hours of every day an old man named William Chadband. His work is light and simple; he is only required to supervise the admission of trains to the platform beneath him, and from his lips one afternoon the present



A PATENT FEATHER-BED TRAIN.

OLD SIGNALS.
L. & S.W.R.





writer learnt his history. He was born in 1817, and worked at the construction of the line before it was opened. In 1839 he went to Nine Elms, where his duty was to disconnect the engines from the tenders and turn them, as the turn-tables were not large enough to allow engine and tender to be placed on them at the same time. These old engines were so light, that he used to move them about by working what were then known as starting-handles to and fro in the same fashion in which an invalid propels his exercising-chair by working the handles attached to cranks on the axle.

Or if another time an engine could not start its load up the slope out of the yard—an engine-load was only 10 trucks as against 40 or 45 at present—he would hitch on two or three horses in front, and pull engine and train away out of the yard together. In those days there was no hard-and-fast line between the different branches of the service, and Chadband was sent for a time to work as a fireman. But engine-driving life was too risky, so he gave that up. In 1841 he left the South Western service and went to Corbett's Lane, the junction between the Greenwich line and the Croydon line, about two miles below London Bridge. At this junction the signalling was managed by two flags; a red flag meant that the Croydon train was to come on and the Greenwich train to stop, while a green flag meant the opposite. But the system, though simple, had its disadvantages, one of which was that a Croydon down train might have been stopped just where a Greenwich up train would cut it in half, and after a short experience Chadband returned to the South Western.

He was then employed for eight years at night-work in the Nine Elms goods yard. Of this his most vivid recollection relates to the terribly long hours that men used to work.*

* One hears much nowadays of long hours on railways. It does not need a profound acquaintance with railway working to know that a good deal of what is said rests upon a very slender foundation of fact. No man can prove a negative, and I have no wish to assert that such a thing as gratuitous and avoidable overtime has absolutely no existence. For there are cases,

One day he watched a train draw down into the yard. The driver's hand was on the regulator, the fireman was standing to the brake, but both men were fast asleep, and the train went through the wall and out into the road beyond. Another time Chadband himself dozed off for a moment as he was holding open the points for a train to pass, and only awoke to consciousness when the last wheel had passed and the switch ceased to vibrate in his hand. His next move was to Waterloo, where he became yard foreman. There was at this time one signal put up outside the station-yard, which of course was worked by a man standing on the ground.

This signal belonged to a long extinct pattern. It consisted of a round disc of metal balanced on its edge on a pole. One half of the disc was solid and painted red, the other half had the interior cut away, leaving only a thin rim of metal. The disc had a double motion. It could be turned round by a cord fastened in a groove round the edge, or it could be twisted as a sixpence is twisted when one spins it. The signal, therefore, could assume four positions. Turned edgeways to the driver approaching, it meant that both lines were clear. Turned across the line, if the open portion was down-

even apart from special causes such as fog and accident, in which long hours are evidently unavoidable. Suppose an excursion train, say from Burton-on-Trent to Brighton. It starts at 4 A.M., and is back at midnight. Practically the same guard must go through the whole way, and though he has ten hours with nothing to do at Brighton, he is reckoned as on duty all the time Take another instance: a small local branch, worked by one engine. The first train in the morning is at 6 A.M., the last at night at 8 P.M. If the public insist that no driver shall be employed for fourteen hours, they must be prepared to forego either the early morning or the late evening train. For the whole receipts from the branch would not pay for the employment of a second engine. But that any of our great railways employ their men when they are falling asleep from over-fatigue, simply out of malice prepense, or for the sake of paying them the higher overtime scale, I for one am unable to believe. The loco-Superintendent of one of the great railways told me a short time back, that on account of the outcry that had been raised, he had been revising the working of his engines, to secure as far as possible that no man had more than ten hours per diem. He had been able to lessen the overtime considerably, and the consequence was that the amount paid in wages for the same total number of hours was perceptibly reduced, and that the drivers were proportionately discontented.

wards, both lines were blocked. If the right-hand or the left-hand half of the disc was open, the corresponding line was clear, while the other was blocked. By a later development when signals of this pattern referred to a branch line, a second disc with a green ring upon it was placed underneath.

Every one has heard of the exceptional precautions when the Queen travels; how the goods working in the sidings adjoining the main lines is suspended, and the points locked; how trains in the opposite direction are stopped; how level crossings are closed and guarded, and the whole line patrolled by an army of platelayers. Her Majesty a few years since, with her usual warm-hearted sympathy, expressed her desire that the same care should be taken of the safety of the meanest of her subjects as is taken of her own. Unfortunately, however, if the same superabundance of precaution were employed in the case of ordinary trains, half Her Majesty's subjects would have to stop at home, for the traffic could never be conducted at all. But in those days on the South Western, by which, before the Great Western branch was opened to Windsor, she habitually travelled,* Her Majesty's wish was fully complied with, and instead of every arrangement down to the minutest detail being worked out days beforehand in the traffic superintendent's office, and printed instructions being sent to every member of the staff concerned, she came and went unannounced, exposed to the same risks as every one else.†

* Though Her Majesty uses it but rarely nowadays, there still exists at Nine Elms, sandwiched in between the main line and the locomotive sidings, what is known as the Queen's private station. [Now abolished, and absorbed in the goods yard. 1899.]

† As I write, there lies before me a perfect library of documents referring to one of Her Majesty's recent journeys from Balmoral to Windsor. On the top of one of them is printed conspicuously the following note: "These instructions must be kept strictly private, and must only be communicated to those persons in the service of the Company, who, in the discharge of their duty, require to know and to act upon them; and those persons must not give any information whatever to anyone respecting the hours or other arrangements set forth in these instructions;" so I must content myself

And the risks were by no means nominal. Here is one experience. In days before the injector had been discovered —that marvellous contrivance by which a tiny jet of steam suffered to escape from the boiler rushes back again in a fraction of a second, dragging at its heels a supply of cold water, in defiance of an outward pressure from the boiler of 140 or 150 lbs. on each square inch of surface—the water from the tender tank was pumped into the boiler by pumps fixed on to the cross-heads of the pistons, and so driven by the motion of the locomotive itself. As long, therefore, as the engine stood still, the pumps could not act, and if it stood for any length of time, the water supply ran low. To meet this difficulty, there were placed in the engine-shed, at the end of the rails and level with them, what were known as friction-wheels. Over these the engine was placed, with its driving-wheels resting on the top of them. The driving-wheels could then be set in motion, so as to work the pumps, the engine of course simply remaining stationary all the time.

But if the friction-wheels were occupied, an engine often set off for a run down the line to Vauxhall, and filled its boiler that way. One day an engine had started on a preliminary canter down what was known as the "light engine line," from the fact that it was almost entirely reserved for this purpose, and was due to return, when to his horror Chadband saw the 11.15 A.M. express—a still existing train—running out of the station on the same pair of metals.

with saying that, not to mention a time-table printed in gold for the use of the distinguished passengers, a neat card showing the gradients of the road along which the train travels, and a plan of the train, indicating the saloon which each person is to occupy, the telegraph arrangements imply that on the North Western line alone some 350 telegrams shall be sent. As for the instructions to the staff, they occupy six closely printed folio pages and give the time of the train past every signal box from Ballater to Windsor. Perhaps we may quote one paragraph out of the twenty-eight as a specimen of the rest: "The locomotive superintendent will select the engines, and take every precaution to secure the most perfect class suited to the nature of the train, so as to avoid any possibility of failure or delay; he will also select the enginemen both of the pilot and the royal train, from the most steady and experienced drivers who know the road well."

He rushed forward, dragged a red handkerchief from his pocket, and, waving it above his head, ran on to meet the approaching "light" engine. It was stopped just in time. Passengers who see railway servants with scarlet neckties probably seldom think of their possible use as emergency danger-signals. But not many weeks back a story, which no doubt has at least some foundation in fact, found its way into the English newspapers, telling how a platelayer, who came upon a solidly-built obstruction maliciously placed upon the line on which the Orient Express was due in a few minutes, saved the train by covering his lantern with a red handkerchief and holding it up to warn the driver.

As long ago as 1869, Captain Mangles, then Chairman of the Company, mentioned at the half-yearly meeting that Chadband was the oldest signalman in the South Western service, and that he had never been responsible for loss of life or injury to a single passenger. Though well-nigh twenty more years have passed since then, he can still make the same boast to-day. One pleasant fact should be added to his story, and that is, that though he has come down to much lighter and less responsible work, he still draws his money at the same rate as when he was in charge of the yard as foreman.

And now let us endeavour very briefly and in the merest outline to sketch the gradual development by which the one signal on the ground at Waterloo, or the candle in the window of the hut at Darlington, has grown into the great "A" box with its 209 levers. It may be that we have not yet reached the end, and that some new failure will suggest some further possibilities of precaution, but at present the tendency is on the whole in the direction of simplification rather than greater complexity. The signals of the modern and now almost universal semaphore pattern had, when first introduced, three positions. Full up, they indicated "danger," "stop;" half-way down, "caution," "go slowly;" right down, "all clear." After a train had passed, the signal was kept

for three minutes at danger, then for seven minutes more at caution, and then after ten minutes it was dropped altogether.

But with the advent of the block system and the electric telegraph, the intermediate caution-signal disappeared. A line worked on the block system, which is at present in force all over the country, except in a few out-of-the-way corners, may be compared to a staircase, of which the stations are the landings, and the sections of line between them the separate flights of steps. No train may leave the bottom of the stair till the flight of steps and the landing beyond it is clear, and so on throughout the length of the line. There is therefore, so long at least as fallible mortals continue to carry out their instructions, no possibility of a train overtaking its predecessor, and the caution-signal is superfluous.

We need not concern ourselves with distant signals, distinguished from the rest by the fact that the arm ends in a fish-tail instead of being cut square. Their function is merely to act as a mechanical help to the driver's vision, and to tell him, when he is as yet half a mile off, in what position he will find the "home" signal. Still less need we regard refinements such as "starting" signals, "advance-starting" signals—whose use in a general way is evident from the name—or "fog-arms," whose business it is to say ditto to the home signal which on its lofty post, sometimes 70 feet in height, may be invisible in a fog. Let us imagine a train approaching a junction of two roads. It may be intended to go to the right or to the left. There is a signal for each road, and a lever to turn the "points" in one direction or the other. But signalmen are fallible, and a man might open the points leading to the left-hand road and drop the signal for the right-hand one. So points and signals are interlocked, in other words all three levers are brought close together, and by a mechanical arrangement it is made impossible to drop the left-hand signal as long as the points are open towards the right, and *vice versâ*. But then there is a risk. The points are perhaps not quite tight closed, and the flange of a

wheel might force them open and throw the train off the line. So another lever is provided, which thrusts a tongue of solid steel through one of two holes in the "stretcher-bar" that connects the points of the two rails, and so bolts them securely in one position or the other. Till the bolt has gone home into one of its two appointed holes, the signal remains immovable at danger. It is thanks to facing-point locks—oddly enough but rarely used abroad—that English expresses drive at 60 miles an hour through junctions where French trains would be required to slack down to 15 or 20.

But supposing the signalman should think fit to put up the signal, withdraw the bolt and then move the points, while a train is passing over them. It is said to have been an error of this kind that cost many lives in the great accident at Wigan some fifteen years since. But such an error can never be made again. Lying along the inside edge of the rails, close beside the points, is a long flat bar of iron. Each time the points are moved, this bar must be raised above the level of the rail. As long as a train is passing, the flanges of the wheels of course render this impossible, as a signalman who would lift it would have at the same time to lift the weight of the train. One refinement more. The rod which moves the points may break, and the signalman be unaware of it. He might push the lever over, then drop his signal, and yet the points might not have shifted. To meet this remote possibility of danger, a system known as ground-locking has been introduced, by which the wires from the box to the signal pass through a second hole in the stretcher-bar in such a way that the signal can only be dropped when the points themselves have actually shifted.

And here our tale of precautions would be complete were it only a single-line junction. But lines are usually double, and it is evident that if a train going on to the right-hand branch were allowed to approach the junction at the same moment as a train was coming off the left-hand branch, a collision must ensue. It is necessary, therefore, that these

two signals should be interlocked, so that, though the signalman may invite either train to come on, and may choose which of the two shall come first, he cannot, if he would, call them both on together. When we come to a maze of junctions such as exists outside Waterloo, where the trains from seventeen platforms converge on to four lines, these interlocking arrangements become most complicated, and in many cases before one signal can be dropped it may be necessary to pull over and lock well-nigh a dozen levers, which might drop signals or open points admitting on to the road that has been "made" for the outgoing or incoming train.

So much for the signals and points that are close to the box under the eye of the signalman; but his distant signals may be round a corner or behind a hill. How is he to know that they are all right? To meet this very real difficulty, electricity is called in. A circuit is carried up the signal post, so that a miniature signal-arm before the signalman's eyes in the box repeats the position of the outdoor signal. But it is useless to put a signal to danger at night if the lamp is out. Again electricity comes to the man's aid. Over the signal-lamp is a tongue of metal that as long as it is hot remains bent, owing to the unequal contraction of the brass and steel of which it is composed. If the light goes out, the tongue as it grows cold straightens itself, and closing the circuit, sets a bell ringing in the signal-box, at the same moment as a small indicator, bearing the words "Light out," drops down in a conspicuous place.*

* "We still need," said the signal-superintendent of one of the great lines to the writer a short time back, "some appliance which may enable a driver, approaching a junction where one of the two signal-lights has gone out, to know which of the two it is." Nor is this the only desideratum waiting to be invented. As to the possibility of confusion between home and distant signals at night, a word will be found a page or two further on. An express, timed to run 50 miles an hour for two hours on end, on whose engine I was travelling a short time back, in a pitch-dark night with driving rain, was brought up with startling abruptness, because the driver suddenly discovered that what he had fancied the tail-lamp of a goods train standing in a siding was really an advance-starting signal against him.

All this elaborate apparatus of precaution belongs to a signal-box, looked upon as a single and independent unit, responsible only for the control of its own section of line. But each box is of course in constant communication with its neighbours on either side. For this purpose the humblest roadside box has its four block-telegraph instruments—one in each direction for the up and the down line respectively—and speaking-telegraphs as well. In addition, at a great junction or terminus, there will be telephones, discs labelled "Light engine," "Empties," "Express," "Local," &c., that the signalman may know exactly what is coming, and electric gongs and bells of assorted sizes, each belonging to its respective code. Among the "might have beens" of history there are few on which speculation is more interesting than the question what form railway working would have taken if electricity had not been developed alongside of the development of the capacities of steam. Certainly there is not a main line in England that without electricity—unless indeed pneumatic signalling had been developed to take its place—could have conducted its traffic on one pair of rails.

The South Western traffic is difficult enough to manage at the best of times, but when a fog comes on, and still more when it lasts five days without intermission, as one did last winter, the difficulties are such as the travelling public can hardly conceive. For one thing, the supply of capable fog-men is strictly limited. Even in fine weather, a new hand unaccustomed to railway working is almost useless to a company; as long as everything is shrouded in impenetrable darkness, save when ever and anon the huge bulk of an engine comes screaming by, lighting up the gloom with the lurid glare from chimney and fire-box, and making the ground tremble as it passes, it would be madness to allow any man upon the line to whom every foot of it was not familiar. As it is, a long-continued fog seldom lifts without leaving one or two gaps in the ranks of the army of platelayers. A year or two back, after some days' incessant fog, the General Manager received notice that the men were

worn out from exposure and want of rest, and unable to stand it any longer. It was thought that a large part of the train service would have to be suspended, when fortunately the wind changed and the fog suddenly lifted. The expense of "fogging," as it is called, is also by no means inconsiderable. The men receive extra pay in addition to their ordinary wages, and are supplied with meals by the Company as well. In a single one of the ten districts into which the North Western is divided, the food alone sometimes costs £100 in a single winter's month. The great fog of January, 1888, caused, to a comparatively small company like the Sheffield, a bill for £1250, including as one item 560 gross of fog-signals. I have a return from a second-class station near London, showing for that station alone an extra expenditure of over £80 per annum.

It cannot, however, be said that the hardship and risk to the men, the cost to the company, and the delay to the passenger and almost total suspension of the goods traffic, represent the whole of the ill effects of a fog. It is undeniable that there is a certain amount of risk to passengers as well. Let no one on this account, however, feel nervous the next time he hears a fog-signal explode. This, like the flash which shows that the lightning has reached the ground, is really a sign of safety. The chief risk is when a fog comes on suddenly, especially in the early morning or late evening, before the fog-men, who may perhaps live a mile or two away, have had time to get to their posts. Or again, "fogging" is never resorted to merely to protect goods trains, and on some lines, where there is only one night passenger train, it is left to take its chance in the middle of them. It has long been felt by railway men that the present primitive system by which a man simply stands beside the distant signal, and, if the arm goes up, fastens a detonator on the line—or rather, for greater precaution, two detonators, in case one should miss fire—and, if the arm goes down, hastily pulls it off again, is a system that stands in need of radical reformation. "Everywhere else," it is said, 'infallible, or

practically infallible, mechanical appliances have taken the place of human frailty: why not here too?" Accordingly, for a long time past attention has been directed to the problem, how best to enable the driver to hear the position of the signal that he cannot see.

Patents innumerable have been filed on the subject. Some of them would merely substitute a mechanical for a

Line Clear. Distant Signal at Danger.

AUTOMATIC FOG-SIGNALLING APPARATUS.
(KEMPE AND ROWELL'S PATENT.)

human arm in placing a fog-signal on the rails. Others would abandon the present detonating signals altogether, and would fix a lever alongside the rails, so that when at danger it may catch against an arm projecting down below the locomotive. But the lever may do various things. One system would make it drop a miniature semaphore across the window of the "cab," so that the driver could not fail to see it. Mr. Drummond, the loco-Superintendent of the Caledonian, has a patent, according to which the lever would instantly apply the brakes all along the train, without wait-

ing for the interference of the driver. Of this system it is perhaps fair criticism to ask whether it is desirable for outsiders to interfere with the management of the train over the head of the driver, and whether it is not quite possible to imagine circumstances—a train having divided coming down a steep incline, for instance—in which running fast through a distant signal at danger might be the lesser of two evils. There is another system, known as Kempe and Rowell's patent, that is at present being tested on the South Western line at Wimbledon. Opposite the distant signal, midway between the rails, is what looks like a third rail some ten feet in length. This bar is jointed in the middle, and is actuated by the same wire that works the signal in such a way that, when the signal is "on," the centre point of it rises some three inches above rail level, and when the signal is taken "off" it again falls flat. On the front of the engine is a vertical rod with a small wheel at the bottom, which actuates a whistle. The rod is just long enough to catch on the middle of the bar when it is drawn upwards, but it will miss it entirely as long as it lies flat.

Mr. Drummond's system would, it is to be presumed, only be brought into action in case of fog. Mr. Kempe, on the other hand, considers that his patent is of universal application, and thinks that it would be a distinct advantage that the whistle should be blown every time a driver passes a distant signal at "danger."* There certainly would be some advantages in the proposal. Many an accident has happened from a driver not knowing what point on the line he had reached. By day a distant signal is unmistakable. It has the arm ending in a fish-tail, instead of cut square; but by night, just when guidance is most needed, all signals are alike with the same coloured lamps. In a fog, therefore,

* Let me repeat, for the benefit of the lay public, that, though a driver who passed a "home" signal at danger might expect to be promptly dismissed, distant signals at danger are constantly passed. Their use is only to tell the driver that the "home" is against him, and to warn him that he must be prepared to pull up, if required.

nothing is more possible than for the driver to mistake his whereabouts. Or again, the distant signal lamp has gone out, the driver fails to see it altogether, the next signal he reaches he takes for the distant signal, runs through it, gradually slackening his speed, and a moment later there is a collision. On the other hand, if every distant signal that was at danger always set the engine that passed it whistling, there would be a good deal of whistling, I fear, in the neighbourhood of London. It is for railway men to decide whether the innovation is practicable and desirable, but even a layman may be permitted to have a very decided opinion that the present fog-signalling arrangements are antiquated and inadequate, and to do what in him lies to direct attention to the subject of their improvement.*

But difficulties of quite another kind fall at times to the lot of the South Western. One of its earliest experiences was of the "Derby" that occurred a week after the opening of the line, in the last days of May, 1838. The Company had advertised their intention of running eight trains to Kingston, and to their astonishment early in the morning a crowd of 5000 persons assembled at Nine Elms. Several trains were despatched, but the crowd increased faster than the trains could carry them off, and at length the mob broke the doors from their hinges, and forcing their way into the station, took possession of a "special" that had been chartered by a private party. In the end the police had to be sent for, and at twelve o'clock a notice in the booking-office window announced that no more trains would be run that day. Since then the Company has had to learn to deal with larger crowds than 5000 without assistance; but no longer ago than the Boat-race day in 1887, it was taken by storm in a somewhat similar manner by a sudden influx of sightseers, who had found it impossible to book by

* [Patents, not in decreasing numbers, still continue to be filed. But, except tentatively and experimentally, no system has yet come into use. 1899.]

the "Underground," and came on in a body to Waterloo. But the worst that happened on this occasion was that a good many passengers travelled without paying their fare. Still, as the Company had succeeded that morning in despatching 15 specials, conveying 11,337 people, in 56 minutes, it cannot fairly be said that the staff were paralysed. Last year the comparatively early hour for which the race was fixed implied for the Company the loss of the fares of 20,000 passengers.

To despatch a train every four minutes may be taken to be the utmost that is possible on any ordinary line. When each section of the line all the way down from the terminus has a train in it, the limit of speed must be the time during which a train can cover the length of the longest section *plus* the time necessary after the section is clear to get through a message to the signalman in the box next behind informing him of the fact. And that can hardly be brought below four minutes.* A short time back, however, by a special effort after Sandown races, twenty trains were got into Waterloo up the main line in the 62 minutes between 5.59 and 7.1 P.M. An account has been given in a previous chapter of the Doncaster race traffic, and the trains that ran every minute and a quarter. But it is one thing to despatch trains from a centre to every point in the compass, and quite another to send them one after the other to a single station down a single line, such as that from Waterloo to Sandown or Kempton Park. The heaviest day's traffic that Waterloo ever knew was on the occasion of the Jubilee Review in July, 1887, when 72 specials between London and Aldershot, added to the ordinary traffic of a Saturday afternoon in the

* The North Western did a smart bit of working one day last summer. They started a heavy special containing the Duke of Cambridge and a large party of distinguished visitors from Euston at 10.5 A.M., in between the 10 o'clock 'Scot' and the 10.10 Liverpool express, and ran it to Crewe without it ever being once stopped by signals. This, be it observed, means not only that the signalmen did their work very promptly, but that the drivers of the trains kept time to the moment at every intermediate station all down a hundred and fifty miles of road.

height of summer, brought up the total number of trains to 783 as the record of the day.

Military traffic is at all times a not unimportant item in the South Western receipts. The line into Portsmouth, the joint property of the South Western and the Brighton Companies, is the only railroad in Great Britain that passes through a fortified *enceinte*, and in the trooping season there is a brisk interchange of regiments between Portsmouth and Aldershot. To Plymouth, too, the South Western has this advantage over the Great Western, that it can forward troops from all parts of England without change of carriage. There is one point worth notice as illustrating a difficulty and expense in working special traffic of this kind that is not always appreciated. From Aldershot to Portsmouth is only some 52 miles, a distance that is covered in about an hour and a half. But the train that takes the troops will need to come down empty from London, and then return empty all the way from Portsmouth, thus occupying practically the whole day and running 150 miles, though the Company only gets paid for 50. At present the South Western is engaged in the construction of a new railway from Fareham to Netley, a line which has been much pressed upon the Company by the War Office, as affording direct access to Portsmouth from the West, and which therefore, may be considered the nearest English approach to a railway built for strategical purposes.

Less than twenty years have elapsed since the railway system of the country was first extended into Bournemouth, by a cross-country single line from Ringwood, full of curves and gradients that limited the maximum permissible speed to the very moderate figure of 25 miles an hour. In 1875, the purchase of the Somerset and Dorset line by the South Western and Midland Companies jointly, made Bournemouth more accessible to the inhabitants of the great towns of the North than any other watering-place on the southern coast. Two express services daily between Hampshire and Yorkshire

without change of carriage are a unique feature of English railway enterprise, deserving not only of record but of emulation. The opening in the last few months of a new line which, at a cost of £700,000, shortens the route to London by some seven miles, may be taken as a measure of the importance of Bournemouth to the South Western Company to-day. And the fact that the saving of seven miles in distance renders possible a saving of something like three-quarters of an hour in time may afford an apt illustration of the difference of the way in which the new and the old lines have been constructed.*

The South Western is the only one among the great companies that has its works in London. The reason of this no doubt has been that hitherto it has confined itself mainly to repairs and bought what new engines were from time to time required. Latterly, however, the authorities have determined to follow the example of every other leading line and build for themselves. Accordingly the carriage shops are shortly to be removed to Bishopstoke to make additional room. So at least it is understood, but there are those who are still incredulous. Indeed, the author was informed at Nine Elms that there was an *employé* there, who, when he came up to London to the Company's service thirty-five years ago, was warned not to make any permanent arrangements in town, as the works were going to be removed to the country very

* The British public, we are told, do not want fast trains; they want punctual trains. An apt commentary on which statement may be found in the fact that they have with one accord crowded into the new 12.30 down and 2.5 P.M. up expresses, till the trains have become so heavy that they have failed to keep time. The remedy, I venture to think, is to be found in levelling up one or two more of the trains to the same high standard, and so encouraging the passengers to distribute themselves more equally. Bournemouth deserves some consideration at the Company's hands; in thirty years its population has increased from 1,250 to 27,000, and its rateable value from £5,650 to £220,000. And it will not stop growing just yet, if the South Western maintain the same rate of improvement that they have recently attained. And they evidently have not yet reached finality. At the last half-yearly meeting the Chairman spoke of arrangements for running to Bournemouth in 2¼ hours as in contemplation.

shortly. Meanwhile, however, Nine Elms is turning out some work of which any line might be proud. A few years back, both in engines and rolling stock, the South Western had undoubtedly fallen below the mark. The carriages were old and small and inconvenient, and the engines, which had been in the van of progress a generation earlier, were mere pigmies by the side of the giants of the present time.

No traveller on the line can have failed to notice the improvement that has been made recently. New engines of Mr. Adams's design, one of which obtained a gold medal at the Newcastle Exhibition of 1887, have been put on by scores, and their immense increase of strength enables the trains to do what they seldom did a year or two back—keep time. So great is the change that has taken place, that it is reported that, whereas a short time back on an average 50 per cent. of the stock were under repair at any given moment, to-day the proportion has fallen to 30 per cent The carriages, too, have not been neglected. Though there is still much stock running that could not be described as "replete with every modern convenience," the new carriages on the fast trains to Bournemouth and Exeter leave nothing to be desired. Practically the whole of the stock is fitted with continuous automatic brakes, and a considerable part of it is lighted with gas.

On one other point the Company merits a word of praise. Alone among the southern companies, it has adopted without exception or reservation the policy of third class by all trains. Nor is there any reason to think it has suffered by its liberality. Few railways have had a more evenly prosperous commercial history. For nearly twenty years the dividend has varied between the narrow limits of 5 and 6 per cent. And latterly there have been considerable signs of an intention to allow the public a larger share of the Company's prosperity.

THE "BRIGHTON" SIGNAL-BOX AT LONDON BRIDGE *

CHAPTER VIII.

THE LONDON AND BRIGHTON RAILWAY.

If on a given day all the season-ticket holders in Great Britain were confined to their houses for a space of four-and-twenty hours, the fact would make little difference to the appearance of the 'Dutchman,' or the 'Flying Scotchman,' or the 'Wild Irishman,' or the other great expresses that we have hitherto been concerned with. But the best trains of

* This box, which is, I believe, the largest in the world, has been visited by so many railway officials from all parts of Europe and America, that it possesses a regular Visitors' Book. But, in fact, to commence the study of the block system at one of the most complicated junctions in existence, is as absurd as though a tyro in pianoforte-playing were to attempt to master a concerto of Beethoven's. The proper place to begin the study of our English block system is a road-side cabin with ten or a dozen levers.

the Brighton Company would be little better than strings of empty coaches. Let anyone travel by, for example, the 8.45 A.M. from Brighton, or the return train at 5 P.M. from London Bridge, and notice the look of pleased surprise with which the ticket collectors accept the tender of an ordinary ticket, and he will realise the dimensions to which the Brighton season-ticket traffic has already grown. We should probably be well within the mark in saying that even now season-ticket holders constitute more than half of the passengers in the superior classes. And there is every prospect that year by year the proportion will continue to increase as it has done uninterruptedly now for many years past.

A dozen years back the ordinary first-class tickets produced £280,000, the second-class £240,000. Last year the totals were £200,000 and £210,000 respectively. But in the interval season-tickets had grown from £129,000 to £189,000, so that they went more than half the way towards redressing the balance.* For, recognising as it does that the season-ticket revenue is the backbone of the system, the Brighton Company does everything in its power to encourage this class of traffic. On no other line are equal facilities afforded. A man may travel in a first-class carriage all over the line, from Sunday morning till Saturday night, for the modest sum of £3, and for £60 he may prolong his occupation for a whole twelvemonth. He may journey every day of his life between London and Brighton for £30 per annum, or, allowing him a holiday on Sunday, 2*s.* per diem; in other words, two-thirds of what the humble cheap trippers pay for their day's outing in "covered cars."

No company, not even the North Western itself, turns out smarter-looking trains than the Brighton main line expresses, or even than many of the suburban trains. Alone of the southern companies, the Brighton has learnt the lesson that the great English lines laid to heart years ago, though foreign companies have not yet begun to master it, that to avoid

* [For 1898 the figures are: first-class, £209,000; second-class, £175,000; seasons, £235,000. 1899.]

unnecessary wind-pressure a train must be uniform in shape; that to look well a train must be uniform in colour; and that a distinctive colour is a perpetual and gratuitous advertisement. No one who meets the familiar chocolate and white of the North Western at Inverness or Tenby, or the conspicuous deep red of the Midland at Bournemouth or Hull, can fail to be reminded of the existence and the ubiquity of those companies. But a South Western carriage often seems in doubt as to what line it really belongs to, and though that Company has recently adopted a distinctive brand of its own, it is as yet very far from having applied it to the whole of the stock. A Brighton train and a Brighton engine proclaim their paternity a hundred yards away. Nor, though the carriages might perhaps be built a little stronger and heavier, and the third-class a little roomier, with advantage to the comfort of the passengers, if not to the locomotive expenses of the Company, need the Brighton shops be ashamed of the work that bears their colours.

The best and newest of the stock is reserved for the season-ticket trains, the 8.45 A.M. from Brighton, the 8.40 A.M. and 9.55 A.M. from Eastbourne, and their corresponding down trains. The Brighton train deserves a special word of notice. Luncheon-cars and dining-cars have now, thanks to the Midland and the Great Northern, become everyday affairs; but till the Midland this summer started a 9 o'clock express to Leeds, the Brighton alone could boast a breakfast-car, in which the preponderance of the business sex is shown by the fact that smoking is permitted throughout. And the same liberty is allowed even when the breakfast-car of the morning becomes an afternoon tea-car on the return journey. For those too who care for a luxury that is Continental rather than English, there are *coupés*, for which, however, the Continental *surtaxe* of 10 per cent. is not demanded. The train is fitted with the electric light, each compartment having two 16-candle lamps, whose brilliancy, if it errs at all, certainly errs on the side of excess rather than deficiency.

But we must not dismiss the electric lighting in a single

sentence, as the Brighton have not only been the pioneers in this immense improvement, but have gone further and faster than any other company. For years past their Pullman cars have been lighted by electricity from accumulators which originally were taken out, charged, and replaced, and at a later period were charged every night *in situ* from a small dynamo at Victoria, driven by a special gas-engine. Simultaneously, however, experiments have been carried on with dynamos on the train itself, and driven by the axle in the guard's van. In its latest shape the machinery is of the most compact nature possible, and is entirely contained—dynamo, accumulators, and all—in a cupboard which only occupies two feet of the van's length. The dynamo runs indifferently both ways, having a set of brushes on either side with a special magnet, which brings the alternate set into action as often as the direction of the train is reversed. The Company have already fitted seventeen trains in this manner, and are so well satisfied with the result, that within the last few months the Pullman car gas-engine has been disestablished, and they are now going ahead fitting up the rest of their stock as fast as the requisite plant can be manufactured. Before long it is understood that the whole of the main line and suburban branches will be supplied.

That gas is an enormous improvement on oil, and that electricity in its turn is better than either, is a point on which the outside public has probably no doubt whatever. But a railway company has to consider the question of cost as well. And on this latter it must depend how soon we shall be finally delivered from the filthy lamps that are only one stage better than the "blazing cressets fed with naphtha and asphaltus," that illumined Pandemonium. Here is a rough calculation Oil lighting costs from £80 to £200 per train per annum, according to the amount of labour expended in keeping the lamps in order. The lowest sum means that the lamps go only half cleaned; the highest will only be reached for a few specially important trains. Gas costs, say, £400 per train in plant to start with and

then about a halfpenny per hour for each burner. The electric apparatus costs about the same sum in the first instance, *plus* a yearly expenditure of £100 or £150 for maintenance. One official of the Company gives the following as a rule-of-thumb formula: If oil lighting costs £100, then gas will cost £125, and electricity £150. Those, however, who have had practical experience say that, if electricity cannot hold its own in price already, at least there is no doubt that it will do so in the immediate future.

Of course there must always be a difference between different lines. On the "Underground," for instance, where light is constantly required, where, moreover, the stoppages are so frequent that the dynamos would never have time to charge the accumulators, gas is a suitable illuminant enough. But on the Brighton it would need to be kept burning all day, though only five minutes in the run from London to the seaside is in the tunnels. So that electricity, which can be turned on instantaneously by the guard as the train enters the tunnel, and turned off equally instantaneously as it leaves it, is evidently used here under the most economical conditions. But a guard who acts as one did some time back, and carefully turns the lights out at the entrance of each tunnel and on again at the further end, has considerable opportunities for irritating the passengers. There is another defect, which, though of trifling importance, is of much more frequent occurrence. When the apparatus is in the tail van, the guard in charge is often only reminded to turn on the light by his own van entering the tunnel, though the front carriages have been in darkness for the past ten seconds. But this could no doubt be obviated, if it were thought worth while, by placing a second switch in the van at the other end, so that either guard could make the necessary contact. Probably, however, as the men get more accustomed to this new duty, the defect will obviate itself.

There is a good deal of originality about the Brighton rolling stock. For one thing, in the suburban, known technically as "block," trains, spring buffers are entirely dispensed

with, and the wooden headstocks, which are situated in the centre of the ends of the carriages, are kept tight pressed against each other by the pull of a continuous drawbar that passes through the middle of them. A few years back these "block" trains were built with ten coaches apiece. To-day they are mostly running, such has been the growth of the traffic, with two, three, or four extra carriages attached to them. The Brighton also is one of the few companies—its neighbour, the South Eastern, is another—that have complied with the spirit of the Act of Parliament requiring a communication to be established between passenger and guard. The great northern companies "keep the word of promise to the ear, but break it to the sense." The common cord communication is little better than a farce. To imagine a nervous girl, or an invalid suddenly taken seriously ill, in the first instance collecting her thoughts to remember that, "though there are cords on both sides of the train, that over the window on the right-hand side in the direction in which the train is travelling is the one by which alone communication can be made," and then hauling in hand-over-hand the yards of slack rope along a train an eighth of a mile in length, is so ridiculous that, if a serious loss of life were to happen which a proper system of communication might have avoided, it would be long before the company would hear the last of it.

No doubt, the companies have an answer to this charge. They would say that the chance of the communication really being needed is so infinitesimal, that they can spend the money in other ways to greater advantage for their passengers. And as the Board of Trade continues to accept the cord system as sufficient, we may assume that its inspectors, who in the matters of signalling, structural stability, and so forth, are certainly exacting enough in their demands on behalf of the public safety, acquiesce in this view. But this line of argument, good though it undoubtedly is as a reason why Parliament should never have passed an Act making communication compulsory at all, is scarcely a justification, now

that the Act has been passed, for the systematic tender of a useless imitation as a genuine article. In the early days of railways the need of communication between driver and guard was thought to be self-evident, and Lieutenant Le Count gives the following instructions as to the best method of effecting it: "The guard should have a check-string to the arm of the engine-driver, and a flexible hollow tube should be fixed from the guard's carriage to the engine, through which the men can converse, which the noise of the engine and train will otherwise render difficult."

On the Brighton line the whole of the rolling stock, except some old carriages only used on the cheap excursions, is fitted with an electric bell in every compartment. The Act of Parliament, however, requires that communication between passengers and guard shall be established in all cases of trains running twenty miles without stopping. So the cheap excursions have to stop at Three Bridges. But the Act says nothing about trains that stop every mile, and accordingly hitherto, though the carriages have been supplied with bell-handles, the Company has not gone to the expense of supplying the necessary gongs and batteries in the guards' vans of the suburban trains. Recently, however, an order has been given that the system shall be carried out in its entirety on every train. The principle is of the simplest. Two wires running the length of the train may be compared to the two sides of a ladder, which are joined together in each compartment by a rung that is broken clean through in the middle. Draw out the bell-pull in any compartment, and the broken rung is instantly mended, the circuit closed, and the bell in the guard's van begins to ring. There is a great deal in imagination, and even though a passenger may know that the signal is much more likely to be used to delay the train by some simple-minded old lady, who mistakes a boiling hot-water tin for an infernal machine, than by himself to avert an accident, yet he is glad to see it and to know that it can be trusted to be in working order. Some of the German lines have gone beyond the Brighton Company in this matter, and

have placed in each compartment a handle by which a passenger can himself apply the brakes directly without waiting to attract the attention of the guard.

Signs are not wanting that the end of the "battle of the brakes" is approaching, and that the end will be that the battle is pronounced drawn. That in a few years' time no passenger train will be run without brakes that are both continuous and automatic, may already be pronounced a certainty.* This result is, like the adoption of the block system, a remarkable testimony to the irresistible force exerted by public opinion even in matters of which it can only pretend to understand the barest outline. A few months back the loco-Superintendent of one of the great lines, one of the most distinguished engineers in the country, told the present writer that he had studied every accident for the last fifteen years, and that not one of them could have been prevented by the use of an automatic brake. Yet he added that his own company were supplying automatic fittings to all their stock as fast as possible. But though a continuous automatic brake is accepted as a necessity, the battle is drawn to this extent, that there are two rival systems left in possession of the field—the Westinghouse and the "vacuum." Scotland, except the "Highland" district, is monopolised by the Westinghouse; England, except in the Brighton, Great Eastern, and North Eastern territory, is the chosen home of the "vacuum."

Apart from technical details of triple valves and ball valves, leak off and non-leak off, that could only be intelligible with models and diagrams, and might perhaps be dull even then, the difference between the two systems may be said to be this: The Westinghouse uses the force of air pumped into a cylinder at high pressure; the "vacuum," the force of the out-

* "Continuous" explains itself. An "automatic" brake is one in which each separate coach carries with it its own reserve of brake-power, which is available to bring it to a stand if detached from the engine; in the non-automatic form the rupture of the train-pipe renders the whole apparatus useless.

side air acting upon an exhausted receiver. But the pressure of the outside air, even into an absolute vacuum, is only equal to 15 lbs. per square inch of surface; the Westinghouse pump forces air in till it exerts an outward pressure of some 90 lbs. to the inch. The Westinghouse system, therefore, can obtain sufficient power, with cylinders and pipes very much smaller than are required in the case of the "vacuum." Against this may be set the fact that the pressure in the "vacuum" is inwards, while that in the Westinghouse is outwards, and so tends to burst the flexible india-rubber connections between the carriages. The liability of pipes to burst is, perhaps on the whole, the main objection to the Westinghouse system, though latterly it has been much reduced by employing pipes of double thickness with wire cores, and replacing them, as soon as they are beginning to grow old and weak, with new ones. If a pipe bursts while the train is running the brakes instantly fly on, and the train is brought to a standstill: and then, for the rest of the journey, on so much at least of the train as is behind the fault, the brake is useless

Still, in spite of this difficulty, there can be no doubt that, outside England, the Westinghouse is the system whose reputation is the highest. It is an open secret that in England "a prejudice against the Westinghouse has been excited in the minds of some railway authorities by the injudicious means"—I borrow the phrase from Mr. Rous Marten's admirable, but all too brief, 'Notes on the Railways of Great Britain'—"adopted for pushing it." On the other hand, it is in England that the "vacuum" has been brought to its present perfection, while on the Continent and in America it is chiefly known in its earlier and cruder forms. Practically the whole of the Brighton stock is, and has been for years past, fitted with the Westinghouse brake. In the course of the half-year ending June 30th, 1887, the brake was worked on trains which ran a little over three million miles. How many times it was applied in the whole six months is not recorded, but on one day, June 27th, a census was taken

of the number of stoppages, and they amounted to 19,585. Trifling failures occurred on twenty occasions in all, or say, once in 150,000 miles, and they caused a total delay of exactly one hour. On the other hand, the brake on three occasions saved the lives of persons who would otherwise have been run over. Nor does this exhaust its merits. "We could never work our trains to time," said a Brighton official to the writer a short time back, "were it not for the Westinghouse. A dozen years ago, when trains were far lighter, and the number of passengers getting in and out at the stations much smaller, my table of a morning used to be littered over with letters complaining of unpunctuality. I scarcely get one such letter now."* What continuous brakes have done for speed, to say nothing of punctuality and safety, may be shortly put in this form. An express twenty years back turned off steam and reduced speed a mile or a mile and a half before it reached a stopping station. A train, a dozen carriages in length, weighing, that is with engine and tender, about 200 tons, fitted with the Westinghouse brake, might run into Paddington Station at fifty miles an hour, and be brought to a stand with safety before it reached the further end of the platform.

We have said much of the Brighton carriages, it is time to say something of the Brighton engines. So let us begin with about the only fault that it is possible to find with them—their puzzling habit of bearing painted on their sides the names of places they are not going to. We might protest, too, that 'Crawley' is, in any case, a name too opprobrious to be fastened upon any engine whose driver is expected to work his train to time. The 8.45 A.M. up from Brighton is probably one of the heaviest expresses in the world; on a Monday morning it at times starts with 26 coaches on, or say a gross load of 360 tons. To Redhill the journey is just 30 miles, and though it begins with a dead pull away from the curved platform up a gradient of 1 in 264, it must

* A pessimistic dweller on the line writes: "We have given up complaining. We know it is useless."

be accomplished to the minute, under penalty of having to crawl behind a South Eastern stopping train all the way from Redhill to London. And be the day fine or rough, and be the rails dry or greasy, the run—30 miles in 40 minutes—is accomplished without fail. Nor does 'Gladstone,' to whose leadership the train is usually consigned, ever find it necessary to appeal to a colleague for support.*

One cannot but feel at times on the Brighton trains that the engines are so good that they would go faster if they were only asked to do so. The 5 P.M. down is allowed 37 minutes from Redhill, and often arrives at Brighton a minute or two before its time. The best of the Eastbourne trains takes 90 minutes for 65½ miles, or barely 44 miles an hour. In comparing this speed with the 54 miles an hour of the Great Northern or the Midland, it should of course in fairness be remembered that the line out of London as far as Croydon, if not as far as Redhill, is terribly overcrowded and complicated with junctions.† Further, a train that only goes 50 or 60 miles is at a disadvantage compared with one that goes 100 or 150. The longer the run, the less effect is produced upon the average by the slow speed at starting, which is due partly to the crowded state of the lines running out of the

* Here are some interesting calculations about this train and its engines. It takes 600 horse-power to draw 330 tons up an incline of 1 in 264 at 40 miles per hour. Of this force one-half goes to overcome the resistance of gravity, that is, to lift 330 tons 20 feet in a minute and a half, or 4400 foot-tons per minute; the other half is absorbed by the frictional resistance to the speed. The 'Gladstone' engines are, however, capable of developing 1100 horse-power if required. The pull on the draw-bars at starting is equal to a dead weight of 11,590 lbs. (say 5 tons), diminishing as the train gathers momentum to 4477 lbs. (say 2 tons).

† The Brighton Company has the credit of being the first to introduce the system of "flying junctions"; junctions, that is, in which one of the branch lines (whether the up or the down depending of course on whether the branch goes off to the left or the right) instead of crossing the main lines on the level and so risking a collision, is carried alongside on an incline till it gradually reaches such a level as will enable it to cross either underneath or overhead on a skew-bridge. There are several such junctions between Sydenham and Croydon.

Metropolis, partly to the fact that the engine has not yet warmed to her work, and begun to steam freely.

Still, even allowing all this, that the light trains from which third-class passengers are excluded, and in some cases second-class passengers as well, should take 80 and 85 and 90 minutes over the 51 miles of comparatively level line between Brighton and Victoria, when some of the finest engines in the world are available to draw them, is a fact that hardly seems to carry its own explanation on its face. Since July last, the Company have been running a new train undoubtedly better than any of the expresses between Brighton and London. An express comes up from Portsmouth to London Bridge every morning and goes back every afternoon (86½ miles), with two stops each way, and a good part of the distance over very heavy gradients, in exactly two hours. The two stops are a later interpolation. At first the train ran through the whole distance. Another very smart train, put on last June owing to the competition of the South Eastern, came up from St. Leonards to London Bridge, 74½ miles, in 105 minutes, say 44½ miles an hour throughout. There was a corresponding train down in the afternoon from Victoria, but it was nine minutes slower. Since the 1st of January, however, these two latter trains have been withdrawn.

We have spoken of the uniformity of the Brighton carriages; the same may be said in at least an equal degree of the Brighton engines. When Mr. Stroudley entered the Company's service some twenty years since, he found 72 different classes of engines in use. To-day the number of classes is more like half a dozen, and even of these many of the separate parts are interchangeable.* As showing

* The extraordinary variety of the Brighton engines arose largely from the conscientious desire of an earlier generation of engineers to prove all things, coupled perhaps with some slight neglect of the second clause of the apostolic precept enjoining us to "hold fast that which is good." The same result was reached by some other companies, such as the North Eastern, from another cause—the amalgamation of a large number of small independent concerns into one great undertaking. What the old variety

how every line has its own peculiarities, so that the practice of one company can never be the model for slavish imitation by another, the description of the problem to be worked out on the Brighton line, as sketched by Mr. Stroudley in a paper before the Institute of Civil Engineers a year or two since, is worth quoting. A railway 450 miles in length, of which 90 miles are within the metropolitan area,* and 15 miles have either 3 or 4 pairs of rails. There are 94 junctions and 20 termini, from some of which the trains have to start away up gradients of 1 in 80 and 1 in 64. The passenger engines each stop on the average 93 times a day. Some of them are coupled up to 16 trains in the course of their day's work. The goods engines on the average can only get over 3½ miles in the hour. Fuel costs 17*s.* a ton as against 6*s.* or 7*s.* in the case of the northern companies.

Here are one or two results from these exceptional conditions. Bogies have never been introduced on the engines. To do so would imply the construction of longer turntables, and longer turntables would mean in many cases—at Victoria, for instance—the purchase and demolition of adjoining property. Again, the high cost of fuel induces Mr. Stroudley to economise coal by warming with waste steam the

meant in point of expense may be shown by one instance. In the running-shed at Gateshead I found that about 200 different patterns of nuts, bolts, pins, &c., were needed to meet the everyday requirements of the 120 engines that have their home there For more serious repairs of course an engine would go into the shops, where it is more than probable that a new axle, or fire-box, or what not, would have to be specially manufactured to suit it. But the modern system of making everything wholesale to standard gauges is not without its compensating disadvantage. Engines go on steadily getting heavier and more powerful, and if meanwhile the gauge of the different bolts and stays and so forth remains unaltered this implies that they are really not strong enough for their work. Repairs, therefore, will no doubt be more cheaply and easily accomplished, but, on the other hand, they will be required at more frequent intervals.

* It may be added, though the fact hardly comes within the province of the locomotive department, that nine-tenths of all the traffic of the line has London and its suburbs either as an origin or destination.

water in the tank before it enters the boiler.* One result of this economy is very obvious to passengers in the fact that the Brighton engines frequently have the paint on their tenders all scorched and blistered. Another, and a more serious one, is that injectors are useless. Hot water does not condense the steam with sufficient rapidity to enable injectors to work, and accordingly recourse has to be made to the old-fashioned device of pumps. But as the feed-pumps only work off the "motion," the Westinghouse air-pump is also pressed into the service, and by a simple contrivance is made available for filling the boiler with water when the engine is standing in a siding.

Let us notice one or two points more. The engines are built with their boilers at an unusual height above the ground. Not only does this make the machinery more accessible, but the Brighton loco-Superintendent is a strong advocate of engines with a high centre of gravity as being the steadiest in running fast round curves. Each driver has beside him in his "cab" a speed indicator. A belt round one of the axles drives a miniature mill-wheel, that is contained in a chamber filled with water, and closed entirely except for a glass tube at the top. The faster the train runs, the quicker the mill-wheel turns, and the higher up the tube it throws the water; and a brass standard behind the tube gives the equivalent of the height in miles per hour. Anyone looking into the cab may also see painted up the name of the driver, a fact that perhaps goes some way towards explaining the spick and span appearance of the Brighton engines.

In England, as a rule, the driver is, as far as possible, kept to one engine; on the Brighton line in particular, the two are as inseparable as a racehorse and his "lad."

* English engines are often said to be extravagant in coal consumption. Here is Mr. Stroudley's calculation: to an outsider, at least, whose standard is the amount of coal used in his own house to warm the drawing-room or to cook a leg of mutton, it will hardly seem excessive: "One pound of coal will convey one ton weight of train 13½ miles at an average speed of 43½ miles per hour."

On some American lines, on the other hand, the engines have no more individuality than so many omnibus horses. Driver and fireman will only work ten hours a day, but an engine need not stand still to be cleaned for more than eight hours out of the twenty-four. Accordingly, if there are fifty engines at a given shed, there will be eighty couples of men to drive them, who, as they come on duty, will take each day whatever engine comes first to hand. That the American system makes a more economical use of the vast capital locked up in locomotives—say £20,000,000 sterling for Great Britain alone —is obvious. But this advantage, according to the English authorities, is more than counterbalanced by the greater care taken by a driver of an engine for which he is individually responsible, and for which he feels a sentiment closely akin to affection. The English system therefore gains in economy of fuel and repairs more than it sacrifices in interest on capital. On such a point of course only experts can decide. But on the analogy of the "bus" horse and the racehorse, a layman may be permitted to suggest that, while the bulk of the American work is on freight trains—partakes, that is, of the omnibus nature—a man has need of all his jockeying to work an English express to time. And no one would expect a perfect stranger to get the last ounce of performance out of the Derby favourite.

The Great Northern can probably boast that they build the largest engines in England, the splendid "8-foot singles." The Brighton Company can certainly claim that they build the smallest, the tiny "A" class, better known as "Terriers." These wonderful little engines, with wheels less than 4 feet, and cylinders only 13 inches in diameter, can keep time on a level line with 16 coaches, and can even work their trains punctually over the very heavy gradients of the Thames Tunnel. To the pioneer of the class, the 'Brighton,' which obtained a gold medal at the Paris Exhibition in 1878, a fact which it has proclaimed ever since, proudly blazoned on its side, the travellers by the Dieppe route to Paris owe a debt of gratitude of which they are probably unconscious. The

Brighton Company were occupied, so the story is told, in urging their partners, the Chemin de Fer de l'Ouest, to accelerate the boat trains between Paris and Dieppe. They even had gone so far as to hint that 40 miles an hour was not an impossible speed. "Forty miles an hour!" said the astonished Frenchmen, "and over such a line! Could you do it?" Mr. Stroudley took them at their word, hitched the pigmy 'Brighton' on to the French train, and drew it into Paris at this phenomenal pace. The argument was convincing, the Ouest surrendered at discretion, and promised that in future they would run their trains, mile for mile, as fast as the Brighton ran theirs. National prejudice may make us suspect that this truly sporting offer is not unconnected with the fact that the chairman of the Ouest is an Englishman. But honesty compels us to confess that the English trains often lose time between London and Newhaven, while the French ones arrive at Dieppe to the moment.

Nor must national prejudice lead us to refuse to the Ouest its fair share of the credit for the admirable steamers that run between Newhaven and Dieppe, as they more than half belong to the French company. In days when the Calais service was still worked by those horrible little cock-boats, the 'Wave,' and the 'Foam,' and the 'Breeze,' whose very names suggested their infinite possibilities of unnecessary motion, the Newhaven steamers were already of a respectable size. For years past the 'Normandy' and the 'Brittany' fine roomy vessels with engines of 2500 horse-power, have covered the 75 miles from pier to pier (the 64 miles given in "Bradshaw" are geographical, not statute miles), at the rate of 20 miles an hour. And this year the 'Normandy' and the 'Brittany' have been superseded by the 'Rouen' and the 'Paris.'

Seeing these steamers in their unfinished state, as the writer saw them last spring, in John Elder's yard at Fairfield, one can realise the cost at which the high speeds of modern vessels are attained. The 'Brittany' has engines of about 2500 horse-power, and goes 18 knots; to get 19 out

of the 'Rouen,' which is only a very little bigger, the horse-power is increased by an additional thousand. The whole of the middle of the vessel is given up to machinery, boilers, stokeholds, and coal bunkers, which combine to weigh some 470 tons out of the total 900 tons of the ship's displacement. As for cargo, there is hardly room for more than the passengers' luggage. Fore and aft are large cabins which have one feature for which travellers should be grateful, a special system of artificial ventilation. Fresh air is introduced through gratings in the floor, and the vitiated air is drawn off all round the sides through tubes which are led into the engine-funnels. These funnels, by the way, are made double, in order to prevent the heat from them being disagreeable to passengers on the promenade deck. There are eight boats, four of them collapsible ones, occupying only a few inches of space against the bulwarks, and all of them provided with patent launching gear.

The service from London to Paris *viâ* Dieppe is advertised as the "shortest and cheapest" route, and though the accuracy of railway advertisements is not always above suspicion, as there are occasionally several shortest routes between two points, just as there are several newspapers possessing "the largest circulation in the world," in this case the claim can be well sustained. By Dover and Calais the first-class fare is 61*s.*, the distance 286 miles; *viâ* Folkestone and Boulogne, it is 57*s.*, the distance 259 miles; by Newhaven and Dieppe the fare is 34*s.*, for 257 miles; a distance that might be reduced to 237, if the Ouest would run *viâ* Pontoise instead of Rouen as at present. On this side the water, the Brighton Company are spending a large sum of money, if not to shorten, at least to improve their road, and are entirely reconstructing the whole of the entrances into Lewes Station, where six different lines meet, so that the trains from London to Newhaven and Eastbourne may have a straight run instead of the present tortuous curves. Last summer also they commenced to run a Pullman car upon the day tidal train.

In another direction, however, they hardly avail them-

selves to the full of their advantages. For reasons best known to its directors—perhaps because their 16 per cent. dividend is already embarrassingly large—the Northern of France refuses to establish through bookings from Paris to the great northern towns of England. Over the Ouest, on the other hand, they have long been in operation. Now, seeing that the North Western and the Great Eastern run their own trains to Croydon, that the North Western runs into Victoria as well, where also the Great Western, the Midland, and the Great Northern run into the adjoining Chatham Company's station, it certainly seems surprising that the Brighton has not yet arranged for through carriages to Newhaven from, say, Doncaster, Manchester, and Bristol, in the same way as is done by the Great Eastern to Harwich.

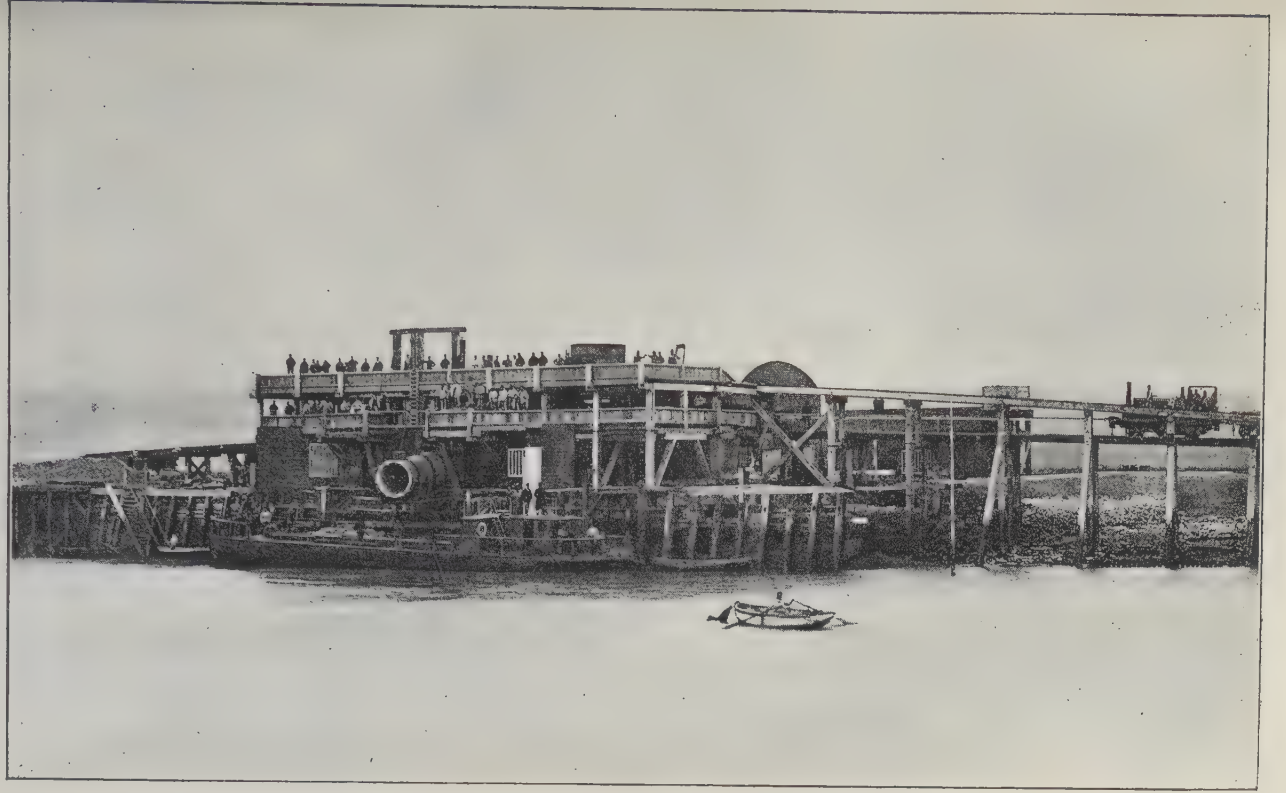
There are two objections to the Newhaven route, which, when combined, are sufficiently powerful to reduce the number of passengers who use it to less than a third of those who go by Calais, and to only two-thirds of those *viâ* Folkestone. The sea-passage is three times as long, and the service is a tidal one. The former objection is for those who enter upon a sea voyage with sinkings of the heart, and continue it with sinkings of a different organ, unfortunately insurmountable; but the latter will be obviated early in 1889. For a long time past operations have been in force on both sides of the Channel for deepening and improving the entrance to the harbours. At Dieppe the cost, which has been, relatively speaking, small, has been borne mainly by the Government, not unassisted by the capitation levied upon every passenger —nine-tenths of them English—who lands or disembarks.

At Newhaven the English Government have confined their support to the appointment of Select Committees and Royal Commissions at intervals during the last half-century. The result of the unanimous recommendations of these bodies, that the improvement of Newhaven Harbour should be undertaken at the public expense as a matter of national importance, has been that the Harbour Board, which is very much the *alter ego* of the Railway Company, has been left

to sink half a million of its own money at the bottom of the sea, and has nearly completed a breakwater over half a mile in length. It has also dredged the entrance to the main channel of the river to a depth that will soon allow the packets, which draw under nine feet, to enter and come alongside the quays at low-water spring tides. A service between London and Paris in nine hours, starting at fixed times, will it is hoped be in operation in time for the Exhibition traffic to Paris next summer.

The method on which the Newhaven breakwater has been designed and constructed by Mr. Banister, the Company's engineer, is so new, at least on the scale on which it is here employed, that it deserves a detailed description. From foundation to the coping of the parapet wall the breakwater is one solid and continuous block of concrete. Above the water-line the concrete is run in inside a framework of boards in a fashion that is common enough. It is in the preparation of the submarine foundations that the originality of the method, which was first adopted by Mr. Cay at Aberdeen, is to be found. The concrete is mixed rapidly, confined in huge bags containing 100 tons apiece, and dropped instantly to the bottom of the sea, where, after adapting itself to the natural configuration of the ground or the space between its neighbour bags, it is left to harden gradually. Let me sketch the process as it may be seen in operation any day at high tide, except when there is a strong wind from the west.

On the quay is erected a big wooden shed, from which there projects over the water what looks like a huge iron drain-pipe. This is the mouth of the mixer. Beneath it is moored a lighter, 100 feet in length, driven by twin-screw engines, and fitted amidships with a well 40 feet long, 8 feet wide, and about 6 feet deep. The well is closed at the bottom by iron folding-doors, on which the water is just awash. A great sheet of jute sacking, with brass-bound eyelet-holes all round, is spread out, covering the bottom of the well and overlapping the sides This is the bag to



NEWHAVEN HARBOUR WORKS.—THE 'TRIDENT' WAITING FOR HER LOAD.

contain the concrete. And now the mixer is set in motion. The rollers above mix and draw downwards the cement and sand and shingle of which the concrete is formed, and it begins to pour out in a thick and constant stream from the mouth of the drain-pipe. Twenty minutes elapse, the well is filled from end to end with a mass composed of some twenty truck-loads of shingle and sand, and 120 sacks of concrete; at a sign from the lighter the mixer is stopped. The twin screws revolve, and off we set to the scene of action.

No sooner are we started than the crew begin to lace up the bag, and by the time we approach the head of the breakwater, three-quarters of a mile away, all is ready for the next step. The vessel slackens speed till, as she reaches her destination, the motion is scarcely perceptible. A man stands beside the bolt which holds together the folding doors on which the bag is resting, with hammer uplifted in act to strike. "Now!" shouts the foreman of the gang, as the marks by which he reckons come into line. Crash! the blow descends, and with a mighty "Ugh!" the mass disappears, leaving a great chasm through which the blue sea surges up in a solid column, to fall again in fountains of foam on the deck as the vessel, relieved of its burden, springs upward and shakes itself like a huge Newfoundland. Leaving the bag with its £5 worth of jute and £30 worth of concrete lying comfortably beside its bedfellows at the bottom of the sea, the lighter turns round and makes for the shore. On the way back the doors are closed and refastened, and a fresh bag is unrolled and spread out upon them, ready to commence again the moment the vessel comes alongside the mixer. And in this fashion each high tide sees two, and sometimes three, bags dropped, till the foundation of the breakwater is raised above low-water mark. A separate staff then undertakes the task of levelling this foundation and erecting the superstructure upon it.

Till recently the Brighton Company ran boats to France from Littlehampton as well as from Newhaven, but they

have now concentrated all their steamers at the latter port. For though the passenger traffic by this road is small compared with that of the short sea routes, the goods traffic is very large, and implies a regular service of cargo boats. Why ladies in London should need to get their hats from Paris, while men in Paris require theirs made in London, may be difficult to explain, but the fact is certain and the rates are remunerative. Fish, too, is sent across the Channel from side to side in immense quantities, often thirty or forty tons of mackerel or herring in a single consignment, according as the price may happen for the moment to rule higher in Paris or London—an obstinate fact this for the people who assert that the railway rates are so high as to cripple the fish trade. Indeed, the quantity of food poured into Newhaven is almost incredible. Butter, eggs sent through from Lombardy in half-train loads, asparagus, and so forth, enter in a never-ending stream. For one month last summer the total was 6000 tons, including, for one item, 190 tons of cherries in a single steamer.* In return, and in consideration of a duty of 50 francs apiece, the Government of the

* When this chapter appeared in its original form these cherries were described, on the authority of one of the Brighton officials at Newhaven, as "Italian." I learnt my mistake in the following manner. The Continental manager of a rival line said: "You were wrong in speaking of Italian cherries coming into Newhaven. We get no cherries from Italy. They won't keep long enough to stand the transit by *petite vitesse*, and the foreign companies refuse, though we have often urged them, to bring their fruit by passenger train. But when your article appeared, to make assurance doubly sure, I wrote across to Messrs. ——, our Italian agents, and asked why, if all this fruit was coming, we were not getting our share of it. They at once replied that I must know that the writer was in error." The story is, I think, worth telling, both as illustrating the contrast of foreign methods with those prevailing in England, where strawberries that were growing in Kent on the Monday afternoon are delivered in Aberdeen in time for lunch on Tuesday, and also as showing the keenness of the competition for business between the different English companies. Let me give two other instances of this. If the market town of Eatanswill has two rival lines, as it has two rival papers, the traveller of the Birmingham hardware manufacturer, or the London warehouseman, as he goes his rounds, will be followed closely, and almost from shop to shop, by the canvassers of the rival railway companies, each anxious to have the privilege of carrying the few hundredweight of

French Republic is good enough to permit us to supply its citizens with bicycles.

In the river above Newhaven lies moored a vessel, whose short if useful career has been brought to a premature end. The 'Carrier' was bought a year or two back to carry goods in the railway trucks, and horses in their boxes, across from Langston Harbour to Brading in the Isle of Wight. The advantages of the scheme were obvious; but unfortunately the expenses were constant, and the consignments only intermittent; the vessel, with her broad square bows, could run but slowly, and could not venture out at all unless the weather was fine; and last spring the service was abandoned.

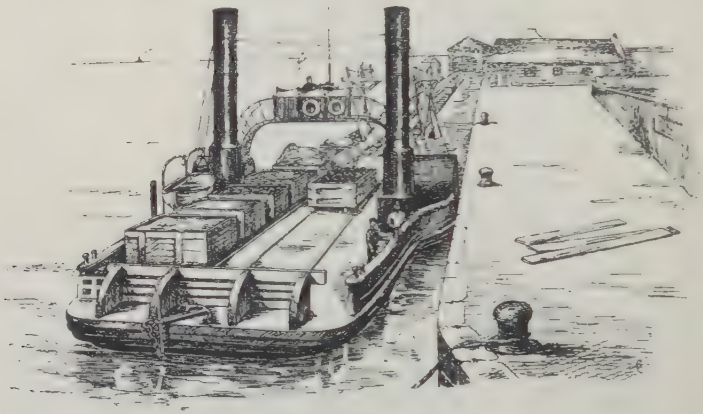
It is now about half a century since railway shareholders first began to urge directors to close their capital accounts. With the best intentions in the world to comply with their proprietors' instructions, no line has closed its capital account yet. Perhaps it would not be a very rash thing to prophesy that, at least till England begins to decline, no line ever will. This autumn the Brighton Company has opened a new line from Oxted to Groombridge, which has been constructed at a cost of somewhere about half a million sterling. The fact that it affords a competitive route from London to Tunbridge Wells is no doubt a legitimate subject for congratulation to the inhabitants, as their fares by the direct line, which have

goods that the ironmonger or the draper will presumably have bought. It is not easy to canvass for passenger traffic in England, but I am assured that no traveller leaves New York for Liverpool without having been canvassed to know whether he will book by the Midland or by the North Western from Liverpool to London. The Midland Company have issued an elaborately-illustrated guide-book to their line for gratuitous circulation in America, and I have in my possession two "folders," as they are called in the States, in the one of which "travelers" are recommended to patronise the Midland as the line which runs Pullman cars, and in the other to go by the North Western as the only line which has introduced brass baggage-checks on the American system. Convenient maps are also inserted; from the one it may be perceived that the natural route from London to Derby is *viâ* Lichfield; the other affords direct connection between London and Crewe *viâ* Derby, Uttoxeter, and the North Staffordshire line.

NEWHAVEN HARBOUR WORKS. FILLING IN CONCRETE.
The object in the foreground, looking like a stranded whale, is a newly-dropped bag.

hitherto been calculated not on the distance but on the time taken by the trains, have already been slightly reduced by the competition of the new and longer route, but it is questionable whether the traffic will be sufficient to fatten the shareholders of two companies. In any case the Brighton Company has made the line sorely against its will.

The history of how it came to do so—and the instance is a typical one—is shortly as follows. It had obtained an Act and begun the construction of a line through Oxted to Edenbridge and Groombridge more than twenty years ago. In the



THE 'CARRIER.'

financial crisis of 1867 the Brighton Company, which had too many irons in the fire at once, got into difficulties, and the following year a new Act was obtained, authorising the abandonment of various undertakings. From that day to this, there has figured this item in the half-yearly report under the head of "Expenditure on capital account": "On lines abandoned under the Company's Act, 1868, £216,400 4*s.* 7*d.*" Years afterwards, the Company having meanwhile resumed its normal position as a prosperous concern, a line was made to Oxted, but instead of following the former route to Groombridge it was continued to East Grinstead. Naturally

the residents along the original road felt aggrieved, and the outcome of their disappointment was the promotion of an independent line. The new undertaking, however, could obviously not afford to provide an independent access to London, so Parliament was asked to give running powers over the Brighton to London Bridge. For two companies to work over one set of metals into London Bridge is bad enough, as the public has lately had occasion to know; to admit a third to partnership would have been simply disastrous. The Brighton opposed and defeated the Bill. The same thing happened the following year. Finally, as the best way out of the difficulty it undertook to make and work the line itself.

The Company has recently had to spend a large sum of money on an even less satisfactory object. On the 27th of July, 1887, the Wednesday afternoon in Goodwood week, the Betchworth tunnel under the grounds of Deepdene, on the direct line *viâ* Dorking and Horsham to Portsmouth, suddenly collapsed. The running sand, through which the tunnel is carried, burst in like water through a broken dam, but, unlike water, did not drain away again. The traffic back from Goodwood had to be sent round by Three Bridges, and the line was blocked and remained closed till the following March. To plug the leak, so to say, involved the expenditure of £20,000, and the practical reconstruction of the tunnel, and the whole experience is said to have been unique in English engineering history.

Surprise is often expressed that railway companies are not ready to grant larger concessions from the ordinary fares to special traffic coming in large quantity, such as that to race-meetings. It would, however, be no paradox to maintain that a Company would often be better without such traffic altogether. It is true that for two or three days in the year it may be profitable, but the profit may only be earned at an expenditure of many thousand pounds of capital, which, except on those two or three days, is absolutely unproductive. It would be difficult to find a better illustration of this than

is afforded at Singleton Station, on the Chichester and Midhurst branch, a mile or two from the Goodwood race-course, What the ordinary takings at Singleton may be, I cannot say, but I should be much surprised if they amount to £20 a week, and that sum would certainly not do more than pay the wages of the station staff and interest at five per cent on the cost of the station buildings. For the whole place—four wide and long platforms, with waiting rooms, refreshment rooms, telegraph offices, and so forth, in addition to water tanks, and cranes, and engine turntable—has had to be built on a lofty viaduct or else on an embankment. And all this, of course, is purely for the accommodation of the Goodwood traffic. A wooden platform and a lean-to shed on it would be all to which the importance of the place would naturally entitle it.

The mention of race traffic naturally suggests an allusion to Epsom and the "Derby." But the "Derby" is not what it was. Year by year its importance, or at least its relative importance, diminishes. Old officers of the Company can still tell tales of a bygone time, before the present Epsom Downs Station was opened, when porters were placed all round the yard of the Town Station armed with thick sticks, with which to rap the knuckles of the roughs who, spite of wet tar and tenter-hooks, endeavoured to clamber over the palings and get into the trains without the preliminary ceremony of taking tickets. But nowadays the "Derby" is hardly more important than a Foresters' or Good Templars' fête at the Crystal Palace. The Downs Station, however, has an advantage over Singleton, in that it is not always idle when the adjoining Grand Stand is shut up. On the contrary, all through the summer, it carries on a brisk trade in Sunday-school children, and similar parties, who come for a day's outing in the bracing air of Epsom Downs. And to these visitors the large covered platforms and sheds—in which, so an advertisement informs us, donkeys, photography, and new milk are, *inter alia*, provided—offer exceptional advantages in case of bad weather.

The Brighton Company pride themselves not a little on their Superannuation and Accident Insurance Funds. Not that directly the shareholders have any reason to congratulate themselves, as they are largely out of pocket by them every year. But there is no doubt both that the men gain directly, and also that the Company, by attracting and retaining a superior class of servants, gains indirectly. The disappointing thing about the Superannuation Fund is that too frequently a man who has accumulated a sum of £10 or £20 to his credit cannot resist the temptation to withdraw it. Sometimes he does so in order to start a small shop, in which case he usually loses all his hard-earned savings. On the other hand, the money may help a man to emigrate to countries where the road to success is less blocked than in this crowded old England. The Accident Insurance Fund deserves a more detailed notice, especially as we hear a good deal just now of the subject of employers' liability, and the Brighton Fund may well serve as a sample of what is done by other leading English companies.

The law, as it now stands, lays upon employers, under certain conditions which are very stringently defined, the liability to compensate *employés* for injuries which they have received in the discharge of their duty, through no negligence on their own part. It is notorious that in practice the employer is rarely made liable. Most of the actions brought into court result in a verdict for the defendant, leaving the plaintiff saddled with costs that he can ill afford. On the Brighton line in particular I am assured, on the best authority, that not one case of accident in fifty would come within the Act. Let us take instances such as occur every day. A guard trips getting into his van after it has started, a shunter tries to pass between two trucks in motion and is caught by the buffers, a porter strains himself lifting a heavy box. Where is the negligence of the Company? That the man has been injured is obvious, but the Company is not legally liable to compensate him. Fortunately the Act is not compulsory. Any *employé* is at liberty to contract himself

out of it, to bind himself, that is, in writing to forego his legal rights, on condition that his employer secures him an alternative which he considers preferable. When the Brighton Company, some eight years back, gave the option to the 19,000 men composing its staff of accepting the terms mentioned below, all but two deliberately contracted themselves out of the Act. Two men, however, preferred to rest upon their legal rights. One of them was out "fogging" not long after. A fog-signal exploded, and a fragment struck him in the eye. The man lost his sight, but the Company had been in no way negligent.

What, then, are the terms that the *employés*, almost to a man, preferred to the covenanted mercies of the Act of Parliament? Briefly they are these. A servant of the Company may pay to the Accident Fund at his option 6*d.*, 9*d.*, or 1*s.* every other month. The smallest sum insures £100 in case of death by accident when on duty, the second £150, and the third £200. In case of injury the allowance is 10*s.*, 15*s.*, and £1, for the three classes respectively: the allowance in each case continuing, if necessary, for fifty-two weeks. And these sums, be it observed, are paid in every case of accident on duty, even if caused solely by the man's own negligence. In practice an even more liberal interpretation is put upon the words. Not long since a signalman at a roadside station came down the steps of his box with a bill-hook in his hand, meaning to utilise the interval before the next train in trimming the hedge of his own garden hard by. He caught his foot, fell, and the point of the bill-hook, entering his arm, severed an artery. It was no part of the man's duty to the Company to trim his own hedge, but for all that they paid without demur.

There are certain persons—mostly of the class who write Labour with a big L and Capital with a big C, and prate of the inherent antagonism between the two (as if they were not both of them merely abstract names for collections of human beings—beings who indeed as a rule belong to the two categories simultaneously)—who assure us that the men

are dragooned into accepting an agreement from which they would gladly be freed if they dare. So let us conclude by quoting the words that are printed on the back of each policy that is issued: "The directors have no objection to the men insured electing a committee of their own number, who may confer with the heads of departments, and if necessary with the board, in regard to any doubtful cases which may arise, or generally as to the working of the scheme of insurance. Any servant of the Company, whether an old or a new hand, may avail himself of the insurance scheme, or retire therefrom at any time and from time to time, on giving a month's notice in writing."

One word in conclusion on a matter to which allusion has already been made. It is an instance of the irony of fate that it is to a report drawn up, in his capacity of Secretary to the Board of Trade, by the present Chairman of the Brighton Railway, that the public owes the benefit of Mr. Gladstone's Cheap Trains Act of 1844.* The Brighton Company runs six trains a day limited to first-class passengers only. In all the British Isles there are but two others. The one is the special Sunday morning mail from Dublin to Queenstown. The other leaves Stoke at 10.50 P.M. for Crewe, and "conveys first-class passengers only, on signing a form indemnifying the Company from all liability in case of accident to the train, &c." What the dangers may be that lurk behind that innocent-looking word "&c." we know not, but no doubt the North Staffordshire Company is correct in

* This is not the only point in which fate has been ironical in the case of Mr. Laing. Here is an extract from his report of 1844: "For two years the public have been deprived of cheap access to the London Bridge Terminus and of the benefit of low fares on the Croydon Railway, owing to a dispute between the Croydon [now Brighton] and Greenwich [now South Eastern] Company as to the amount of toll to be paid by the former for the use of 1¾ miles of the Greenwich line. The extent of inconvenience to the public may be judged of from the fact that the number of passengers using the Croydon railway in the course of the year fell off more than 200,000, owing to the dispute and consequent increase of fares, and that the Croydon Company were actually on the point of abandoning this traffic altogether."

assuming that it needs the high-bred courage of a first-class passenger to encounter them uninsured. Even the "Queen's messenger" trains on Deeside have lately abandoned the restriction to first-class. In addition, the Brighton Company have nine other trains from which third-class passengers are excluded. Not counting the boat-trains to Queenborough, Dover, and Folkestone, which cannot perhaps be expected to carry third-class passengers as long as the Continental companies refuse to admit them to the corresponding trains on the further side, the rest of Great Britain can show—of main line trains at least—but six.*

Now it is true, as has just been said, that some of the Brighton expresses are even now as heavy as they could possibly be. To admit third-class passengers would mean the duplication of these trains. It is true, too, that since the express fares to Brighton were abolished, a few months back, the whole sum has been practically a dead loss to the Company. The lowering of the fares from 12*s.* 6*d.* to 10*s.* has failed to attract a single extra passenger into the superior

* The list is as follows:—

11.45 A.M. Paddington to the West and corresponding up train.
8.20 P.M. Irish Mail and corresponding up train.
8.55 A.M. up, and 5.5 P.M. down, between Fenchurch Street and Shoeburyness. It should be added that the second-class fare is less than a penny a mile.

Besides these which carry no third-class passengers, the day Irish Mail and the 10 A.M. 'Scot' between King's Cross and Edinburgh only admit them under special conditions. I have ignored the Isle of Wight, where most of the trains are first and second class only. The fossilised railway system of that charming island was evidently brought by some prediluvial glacial drift from the Continent of Europe. Nor have I included the 9.55 A.M. from Tunbridge Wells (Brighton) to Tunbridge (South Eastern), as I am uncertain to which company the discredit of it properly belongs. The so-called Crystal Palace expresses on the Chatham line also are first and second only. But why, no human being knows. [It is worth while bringing this list up to date. The Brighton now has four trains first-class only, and ten first and second only. The Continental expresses of the South Eastern and Chatham (with two exceptions), the Chatham expresses to the Crystal Palace, and the Isle of Wight trains, also continue to exclude third-class passengers. But elsewhere in Great Britain the custom is absolutely extinct. 1899.]

class. But for all that, I cannot believe that the circumstances of the Brighton Company are so exceptional that the policy of restriction which has been deliberately abandoned as mistaken elsewhere, can in the long run be profitable here. I have shown that season-ticket holders are the best and most favoured customers of the Company, and season-ticket holders certainly on the average pay less than third-class rates. Even if the direct loss were at first considerable, I should still advocate the change. In these days of fierce competition between different seaside resorts, it is hardly possible for a Company to pay too dearly in order to purchase a reputation for liberality.

CHAPTER IX.

THE SOUTH EASTERN AND THE CHATHAM RAILWAYS.

"THIS wise world of ours is mainly right," is a proverb whose truth, in days when the highest art of the statesman is held to be the accurate enumeration of potential noses, it would be rash for meaner mortals to attempt to controvert. And it is beyond question that the two lines which are the subject of this chapter have not been accustomed to receive so favourable a verdict at the bar of public opinion as some of their compeers. Without therefore attempting to argue in arrest of judgment against what Lord Bramwell once described as "that *caput lupinum*, a railway company," it will be more profitable for us to remember Mr. Foxwell's saying that "no one should be allowed to criticise till he can first appreciate," and to endeavour to put ourselves in a position to grumble as legitimately and as effectively as possible.

Let us notice first the question of railway accommodation. There is belief, not uncommonly held in England, that English railway carriages are inferior to those on the Continent. It may be found expressed as follows in the words of "Baedeker": "The second-class carriages [in Germany], furnished with spring seats, are often superior to those of the first class in England;" and again, speaking of France: "The first-class carriages are inferior to those of other parts of the Continent, and resemble those on most of the English lines; the same remark generally applies to the second-class

also." Now it may be that previous to 1870 there was some foundation for these statements, but to-day they are simply ludicrously incorrect. As for Germany, it is true not only that the first-class carriages furnish their passengers gratis with crochet antimacassars and red cotton-velvet seats in the height of summer, but that the second-class have spring seats—so springy indeed that anything short of the weight of an average German has a tendency to jump off them—but for space per passenger, and width of seat, which, after all, is the main item of comfort to the traveller as it is of expense to the railway company, a German first is certainly inferior to a North Western third. If it were a question of smoothness and steadiness of travelling, the wretched little German four-wheel coaches, with their cast-iron wheels and rickety springs, would be positively unsafe at the speed of English expresses. Even Herr Baedeker would not, we presume, invite us to admire the windowless trucks that are described as third-class carriages on the railways on the further side of the Rhine.

But he is good enough to admit that we are about on a level with France. Let us see how far that is so, and for the sake of comparison let us imagine ourselves passengers by the 11 o'clock "Boat" to Dover. It matters not whether we go down by the South Eastern, whose proprietors get about 5 per cent. for their money, or by the Chatham, whose ordinary shareholders have never yet come within sight of a dividend. Except in external painting there is little to choose between the carriages of the two companies on the Continental trains.* Having for the sake of accuracy brought with us a two-foot rule, we note that the bogie carriages have first-class compartments 7 feet 6 inches wide by 7 feet high

* In one particular the South Eastern is certainly superior. It supplies lavatory accommodation for second-class passengers, being the only English company that does so, though the Midland has now a large number of third-class lavatories, and the Great Northern has also built two or three. The South Eastern has recently given a large order for new rolling stock, so we may expect that before long the gap, at present undoubtedly a wide one, between its best carriages and its worst, will be narrowed somewhat.

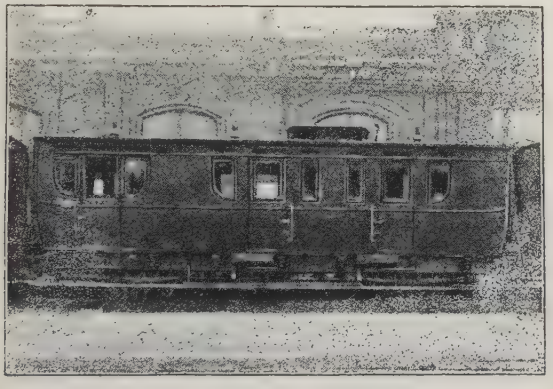
and 6 feet 6 inches long across the seats, that is, allow a fraction less than 57 cubic feet of space to each of their six passengers. The second-class are similar in width and height, but only 6 feet across the seats, and they are supposed to accommodate eight passengers, say 40 feet apiece. And now let us transport ourselves in imagination across the Channel, a method much to be preferred even to the superb 'Empress,' to say nothing of the Channel Tunnel, and measure Herr Baedeker's accuracy with our two-foot rule.

FIRST AND SECOND CLASS COMPOSITE, SOUTH EASTERN RAILWAY.

The Nord first-class drawn up on the pier is on four wheels, and would scarcely be passed as fit for main line traffic in England at all. Each compartment is 8 feet wide, just 6 feet high, and 6 feet across the seats, so that it allows its passengers—eight in number against the English six—exactly 36 cubic feet apiece. As for the second-class they may rub their twenty knees together in a carriage barely 5 feet across, but before they begin to grumble that they have only 24 cubic feet allowed per head, they will do well to remember that the unexampled depression of recent years has compelled the Nord to reduce its dividend to 16 per cent., so they

cannot in fairness expect any very rapid or far-reaching improvements just at present. On the other hand, it would not be right to omit from notice the fact that the dimensions given above are the irreducible minimum. In reality, while the French companies practically fill each carriage to its utmost capacity, the English trains have at least twice as many places as they carry passengers.*

But perhaps the Nord is not a good specimen of a French company, so let us look at some of the "foreign" stock to



VOITURE DE LUXE, CHEMIN DE FER DU NORD.†

* Here are in tabular form the figures given in the text:—

		Dimensions in feet.			Cubic feet.	No. of passengers.	Feet per passenger.
		Height.	Width.	Length.			
First-class	English .	7	7½	6½	341¼	6	56⅞
	French .	6	8	6	288	8	36
Second-class	English .	7	7½	6	315	8	39⅜
	French .	6	8	5	240	10	24

† It ought to be mentioned that the luxurious vehicle illustrated above is not everybody's money. The charge for a seat in it is 12*s.* in addition to the ordinary first-class fare.

be found in Calais Station. Here is a first-class carriage, and though the colour of its paint has long become indistinguishable to ordinary mortals beneath innumerable layers of dirt, the keen sight of our experienced companion recognises it as a Paris and Lyons carriage, aged 35 years. When a short time back evidence was given in a law court that the South Eastern Railway still ran occasionally on local trains some old coaches that were put on to the road in 1852, an English newspaper suggested that these carriages should be withdrawn and exhibited at the Glasgow Archæological Exhibition; but a carriage of the same age is apparently found suitable in France for the "International Express" services. Two points more: the one, that at Calais one may seek in vain for such a luxury as a smoking compartment, and that when one reaches the Nord terminus in Paris one may seek in vain for what might have been thought a necessity—a restaurant or at least a buffet: the other, that on French, as on English railways, sleeping carriages are now provided. Avignon is almost exactly as far from Paris as Perth is from London. To the latter the excess over first-class fare is 5*s.*, to the former it is two guineas.

The truth is that, apart from the question of fares, of which more anon, there is little of which passengers can complain in the Continental service as far as the English companies are concerned. Quantity is certainly amply provided for. Each Company works three trains a day in each direction, in connection with the steamers between Dover and Calais. In addition, the South Eastern has its day express, and its night slow-boats *viâ* Folkestone and Boulogne, and three connections each way with Ostend; while the Chatham Company carries between Queenborough and London the passengers to or from the splendid boats of the 'Zeeland' Line. Owing partly to the fact that the line is single beyond Sittingbourne, the speed of the Queenborough trains is slow, but the Dover and Folkestone trains can hold their own with any trains in Great Britain, except a few picked North or Manchester expresses. The best

South Eastern is timed to do the 75½ miles from Cannon Street to Dover in 96 minutes;* while the Chatham runs in the winter a *luxe* train twice a week, which lands its passengers on the Admiralty Pier precisely 100 minutes after leaving Victoria, 78 miles off.

In apportioning the merits of these two runs it should be remembered that, while both are over very hard courses, the Chatham route is decidedly the harder of the two. On the other hand, the South Eastern, which carries the mails on the morning and evening trains, and slips coaches off the 11 o'clock for stations from Ashford to Folkestone, has a good deal the heavier trains. If anyone wishes to appreciate the revolution which the weight of modern expresses has introduced into recent locomotive building, let him go to Cannon Street and compare the massive bogie engines that Mr. Stirling has lately built for the Company with the pretty little brass-mounted toys that drew the Dover trains some twenty years back. The new engines, which have a distinct family likeness to their Doncaster cousins, are said to be able to keep time with the heaviest train on the line. And to take 20 coaches on the Tidal Train, or the 8 o'clock on Indian Mail nights, up the 11½ miles' climb from New Cross to Halstead in 18 minutes, is no trifling feat.

But the improvement in the locomotives has hardly kept pace with the improvement of the steamers. From the 'Wave' to the 'Empress' is a tremendous stride to have taken within a dozen years. The first impulse to the improvement of the Channel service was perhaps given by Sir John Fowler's project for a ferry boat which should carry across the train bodily. This remained a project only, but early in the seventies two vigorous efforts were made to lessen the horrors of the middle passage: the one by Sir Henry Bessemer, with his swinging saloon; the other by Captain Dicey, with his twin-ship 'Castalia.' The 'Bessemer' was a conspicuous failure from the beginning; but the 'Castalia,'

* This is the time in the working-book: Cannon Street, depart 11.7 A.M.; Dover Town, arrive 12.43 P.M.

though for want of sufficient engine-power she was not a commercial success, at least showed that the principle of the design was right. What has become of the 'Bessemer' I know not, but the 'Castalia' was sold some years back to the Metropolitan Asylums Board, in whose hands her immense breadth has been made to do good service to the inhabitants of London. Eight large and airy huts that have been erected on her decks were filled four years ago with over a hundred small-pox patients, and though for a long time past they have had to accommodate nothing more than piles of disused bedding, the vessel is still ready to be put into commission at a few hours' notice if the disease, which has been raging in various parts of England for some time past, should once more take hold and begin to spread through the Metropolis.

The year 1878, the year of the Paris Exhibition, saw the 'Calais-Douvres' (most ingenious of names for a twin-ship), an improved 'Castalia,' upon the station, and it shows the strides with which improvement has advanced since then, that this year sees her practically discarded, as her 13 knots an hour speed makes her too slow for the day services, while she is too large and unhandy for the night work. The era of high speed began when the South Eastern built the 'Albert Victor' and the 'Louise Dagmar' to work the line from Folkestone to Boulogne, which they have done ever since, seven days a week—29½ miles in very little over the hour and a half. But the Chatham Company did not long remain behind. In 1882, abandoning the idea of specially-constructed boats, it launched out boldly with the 'Invicta,' a vessel over 300 feet in length, with engines of 4000 horse-power. The 'Invicta' brought the time for the 24¾ miles' passage down to 69 minutes; but not content with this, in 1886 the Company put on the 'Victoria,' of 5000 horse-power, and last year the still larger and faster sister-vessel, the 'Empress.' This latter habitually makes the passage in a few minutes over the hour, and on the 25th of June last she broke the record, and did the journey some seconds

under the level hour. With vessels such as these the most exacting passengers must surely be content. Indeed, as far as the Chatham Company is concerned, the public appreciation has taken the, to them, satisfactory form of the transfer of 20,000 passengers to Calais in 1887, who in 1886 crossed over to Boulogne. And the spirited policy of this struggling Company has so far been successful, that more large new boats will probably be ready in time for the Paris Exhibition traffic of 1889.

The opening of the Paris Exhibition is to see, so it is understood, a vast improvement in the connection between the two chief capitals of the world. A train, which has already been christened ridiculously enough the "club" train, is to leave London at 4 P.M. and land its passengers in Paris at 11.30, and a similar train is to run in the opposite direction. The carriages on both sides of the water are to be entirely on the American principle, so that dinner can be served and luggage examined *en route*. Nor is this all. It is in contemplation that the English train shall be composed of cars starting one from Leeds, another from Manchester, and a third from Liverpool, and all uniting in London and so going on to Dover. There is, however, one objection: that the times of starting from and arriving at Calais would be between 7 and 8 P.M., and that is the hour at which the lowest tides occur, when it might be impossible for one of the big boats to get in and out of Calais Harbour.

We promised a page or two back to revert to the subject of fares between London and the Continent, which, as one critic remarks, are calculated by these two Companies "on a truly imperial scale." It is easy enough of course to justify high fares from the railway manager's point of view. Probably a rough estimate that put the average South Eastern fare for first or second class at half as much again as that on the northern lines would not be far wrong. Nor should we be far wrong if we said that Felixstowe or Cromer are growing more rapidly than, say, Sandgate or Westgate,

because of the liberal spirit in which the Great Eastern conducts its traffic. At the same time no one, except perhaps a member of Parliament, is likely to deny that the duty of a board of directors or a general manager is to consider the interest of the shareholders before that of their customers, and still more before that of the general public.

Now there is no difficulty in showing that a reduction of the first-class fare, say to Hastings, from 15*s.* to 10*s.*, would involve a very serious immediate loss. Whether the loss would ever be directly recouped is questionable. As was mentioned in the last chapter, the Brighton fare was reduced a short time back from 12*s.* 6*d.* to 10*s.* without inducing a single new-comer to travel first-class. Nor have the sweeping reductions of first and second class fares on the northern lines a dozen years back done much to check the prevailing gravitation of passengers into the third-class. But in any case it would be years before the Hastings traffic receipts would recover from the reduction, though no doubt indirectly it might stimulate the general traffic of the place, and so recompense the Company in another way. Looking at the matter, therefore, from a purely business-like point of view, directors may well hesitate to ask their shareholders to submit to a certain and immediate sacrifice of dividend, on the chance that after an interval of years it may do even more than regain its former level.

But apart from this general justification of what one is naturally tempted to describe as an illiberal policy, the Continental fares can plead the very sufficient justification that they are even now no more than barely remunerative. The steamboats are excessively costly to work, partly from the mere fact of the high speed, but much more from the nature of the services required. Take the Folkestone-Boulogne service. The time at which the passengers from London arrive at Boulogne is only a few minutes before the time at which the passengers from Paris are due to depart. There is not sufficient margin to allow of the one boat going and returning the same day, and accordingly each boat employs

its crew, burns coal to get up steam, and so forth, though it is only earning money for about one hour and a half out of the twenty-four. As for the Calais service, neglecting the goods traffic altogether, there are three regular boats each way daily, or say a mileage of 150 miles per diem.

To do this, which the 'Empress' could accomplish in seven hours' continuous steaming, the Chatham Company—which works the whole of the Dover, as the South Eastern works the whole of the Folkestone boats—has to keep on the station a fleet consisting of eight of the small boats, the 'Calais-Douvres,' the 'Invicta,' the 'Empress,' and the 'Victoria.' And, what is more, the officials declare that, if the arrival or departure of the Indian Mail occurs at the same time that boats are required for "distinguished service," as it is called, they often find the utmost difficulty in keeping pace with the requirements. It is a serious matter to delay passengers, it is a yet more heinous crime to delay Her Majesty's mails, and one boat has at all times to be kept in reserve on each side with steam up ready for all emergencies. From the published accounts of the two Companies it may be seen that in 1887 out of a gross receipt of £124,000 from their steamers, the Chatham Company, after making the certainly not excessive allowance of £5000 for depreciation, only netted £34,000, while it cost the South Eastern £56,000 to earn £65,000.

Here is another condition that leads to extra expense. The French Government stipulate that their mails shall be carried under the French flag, and accordingly a separate set of boats has to be maintained to work the day or French mail, from those which work the mid-day service and the night or English mail. Hitherto the French service has been worked exclusively by the small boats, but in the spring of this year the 'Invicta' was 'francisé,' as it is termed—transferred, that is, to the French registry under the name of a French owner and manned by a French crew. Henceforward it is intended that under ordinary circumstances the 'Invicta' shall perform the service, but to provide for

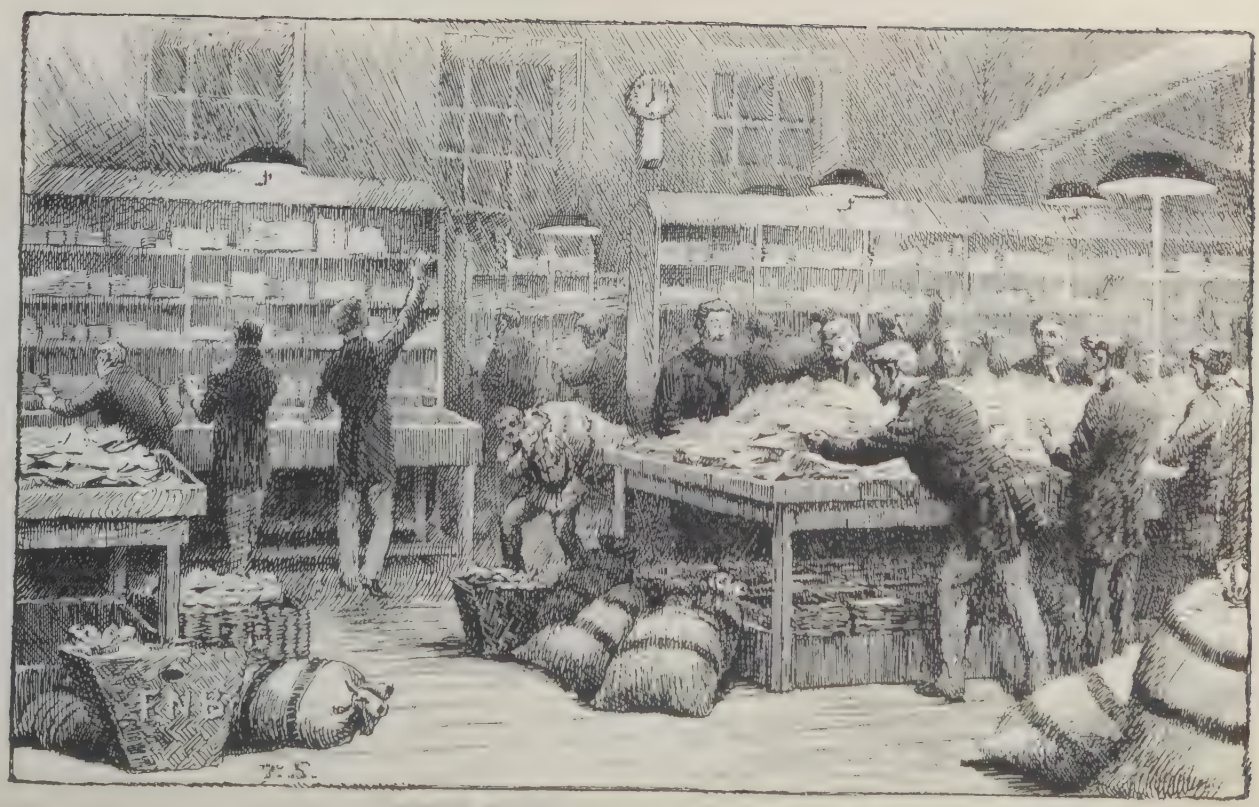
contingencies there are four other boats 'francisé' to help her. Perhaps, on the whole, English people ought to be grateful to the French for their moderation in this matter. English boats are only allowed to carry half the mails to France, but not a letter may they carry to other neighbouring countries. The Belgian and the South German letters are taken by Belgian boats to Ostend, the whole of the Dutch and the North German letters go by the Dutch boats to Flushing.

When it comes to passengers, however, the Ostend service is not so fortunate. Last year, with three boats each way daily, it took less than half the number of passengers who went by the single Folkestone-Boulogne service. A short time back two new Belgian-built vessels were put upon the station with a great flourish of trumpets, but they have since disappeared in a somewhat mysterious manner.* Rumour says, however, that on several occasions they got across the Channel without any mishap. Certain it is that the old boats, which are about the size of respectable tugs, were running again last winter, aided by the 'Manx Queen,' which was hired from Barrow, and that a new and very fast boat, the 'Princesse Henriette' of over 1000 tons, was built last

* There is a story current at Dover which, if it only were true, would no doubt explain their untimely fate. Anyone who is persuaded that English manufacturers are invincible, except by unfair means, can believe it, if he thinks proper. The story runs that a great Clyde firm were invited to send in tenders and specifications for these vessels. They tendered accordingly, but fearing an intention to get hold of their ideas without giving them the job, they deliberately inserted in the specification of the machinery certain features which they knew would be found impracticable, meaning, if they got the contract, to introduce alterations afterwards. They did not get the contract, which, as stated above, was given to a Belgian company. The Belgian vessels, when they appeared on the station, were found to have reproduced the objectionable features of the Scotchmen's design. Here is a second story, which has, I believe, more foundation in fact. When the King of the Belgians was coming to England some time last winter, he proposed to come in the 'Manx Queen.' "No!" said his ministers, "the King of the Belgians must encourage native industry and travel in a Belgian vessel." The King cut the knot of the difficulty by going round *viâ* Calais.

summer for the Belgian Government by Denny of Dumbarton, and that a companion vessel is expected to follow shortly. Meanwhile the Belgian authorities are not too eager to push the advantages of the port of Calais. There is an important train which arrives at Brussels from Germany at 10.58 A.M. There is also a train which leaves Brussels at 10.32 A.M. for Calais, where it arrives 53 minutes before the Dover boat is timed to start. It has been thought, therefore, by radically-minded persons that it might be possible to delay the 10.32 from Brussels till after the arrival of the 10.58, but the Belgian authorities fail, they say, to see that the connection is required.

One of my first experiences behind the scenes of the great Railway stage, with its complicated machinery, where all the actors, however humble, have their allotted parts, and where there are no "supers," was a run in the sorting vans of the 'Special Mail.' That experience I have described in the chapter upon the North Western Railway. Let us here notice a special mail of a very different kind. All the world knows that the Indian Mail is despatched from London on Friday evenings, but perhaps every one does not realise quite what that means. If the sorting of letters to be despatched from Euston is not finished by eight o'clock, they can be sorted afterwards when they get on board the travelling post office. But for the Indian Mail every sack must be closed and sealed in the General Post Office before it leaves. Perhaps in all England there is no better specimen of work done at high pressure than may be seen at St. Martin's-le-Grand any evening from 6 till 8 P.M. But if anyone wishes to see the rush at its very fiercest, let him choose a Friday for his visit. When the present writer saw it on April 13th, the mail as it left for Calais consisted of 871 sacks, filling seven luggage vans, or *alléges*, to use the French technical term. Out of this number, however, 319 had been sent on to Dover in the course of the week, and 28 more on the Friday morning; the rest went down on the Friday night.



FOREIGN DEPARTMENT G.P.O. TIME, SEVEN P.M.

The great bulk of the contents of these latter 524 bags only began to reach the General Post Office late on the Friday afternoon. As 6 o'clock approached, the rush grew fast and furious. Letters and newspapers arrived in carpet-bags and hampers, and were emptied headlong down the yawning gulf into the receptacles beneath. These receptacles, baskets the size of clothes-baskets, were filled and replaced every minute, till, as the clock began to strike six, there came a lull. As the last stroke resounded, automatic machinery closed the shoots with a resolute snap that gave notice to all concerned that no more letters would go to the East that week unless they were provided with extra stamps. With extra stamps they would still be admitted up to 7.15. But St. Martin's has so far only received its own local collections. Simultaneously, though of course on a smaller scale, posting has been going on all over the Metropolis. All these letters and papers have to come to the G.P.O. to be sorted. Not only this, but from all quarters of the kingdom mail trains are hastening towards London with their contributions to the total. At 5.45 the Irish letters reach Euston, at 6 the West mail is due at Paddington. Half an hour later Liverpool and Manchester send their final consignment, while the mail from the West Riding is not timed to reach King's Cross till 6.50 P.M. The rough sorting of the letters from these places has been done before they reach the G.P.O. The foreign letters have been tied into two sets of bundles; the one marked with a pink label, implying that they are for places beyond Europe, the other set bearing a blue Continental ticket. But everything has to be re-sorted at St. Martin's-le-Grand, and the train must be got away from Cannon Street at 8.13 P.M.

At 6.30 P.M. one would be tempted to say that the attempt was hopeless. Letters and papers for the ends of the earth are still in huge heaps downstairs in the great hall, mixed up with all the correspondence not only for the provinces but for the London local offices. Gradually the incidence of the pressure shifts, and the foreign matter is got

off to the Foreign Department upstairs, where 200 additional sorters are at work for this particular evening. Here too the pressure moves steadily forward. The first sorting, let us say, separates Brindisi letters from those to be despatched *viâ* Southampton or Ostend. The second divides the Australian letters, say, from the Indian. The third breaks up the Indian among the seven different divisions into which they are assorted. And meanwhile a similar process is being carried on with newspapers and book packets. By 7.30 P.M. the first sorting seems to be all but finished, and the tables are well-nigh cleared, when in comes a truck and turns out half a dozen sacks of the Leeds mail on to the floor, and so the whole process has to begin *de novo*. Now too the late letters posted with extra stamps up to 7 P.M. at the District Offices begin to come in: and the registered letters that have been dealt with in a separate department appear in their little pink bags to take their places, like the money of Joseph's brethren, in the mouths of their respective sacks.

To anyone who is only accustomed to private correspondence, and who feels shocked at his own extravagance if he allows an Indian letter to cost anything beyond its customary 5*d*., the amount the great business firms must pay for postage seems positively appalling. Letters with 5*s*. stamps are as plentiful as blackberries. 10*s*. stamps are common, while Her Majesty's effigy with £1 blazoned on each side of it may be seen on all sides. On one of the tables the present writer picked up two letters consecutively. The sender and the addressee—a London bank and its Calcutta agency—were the same in both cases. The postage on the first was £1 10*s*. 5*d*., on the second £1 2*s*. 11*d*. Letters of course pay the lion's share, but newspapers, which go at less than one-thirteenth of the letter rate, furnish about six-sevenths of the total bulk. Even newspapers, however, do not go quite for nothing. The proprietor of two leading trade journals states that his postage *viâ* Brindisi costs him between £1000 and £2000 per annum. Of one

issue this spring he sent close upon two tons to the East, but a certain proportion of the copies of this particular number were forwarded as freight. This is a custom that is being more and more commonly adopted every year in the case of special publications, such as for instance the Christmas numbers of the illustrated journals.

And now it is almost 8 o'clock, the letters in neat brown paper bundles have been packed into their respective sacks,

FOREIGN DEPARTMENT, G.P.O. TIME, EIGHT P.M.

and the caldrons of boiling sealing-wax are in active employment. The bags are being rushed down the shoot that lands them in huge red vans beneath. So it is time to leave the Post Office and walk across to the station. At Cannon Street we find, in addition to the ordinary travelling post office, three extra-sized luggage-vans, that as they gradually fill up are closed and fastened. At the last moment, in dashes a messenger breathless, with a couple of bags containing two or three letters that have been delayed or

missorted, and so failed to be included in their proper place. These are thrown hastily into the travelling office, and at 8.18 we are off for Dover. As far as the Indian Mail is concerned the work is now completed, the mail is finally closed, and the officer in charge has nothing to do but to make out and check the complete list ready to be handed over at Calais to the officer who goes through with the train to Brindisi.

This same fact that the mail is closed in London is one that (so at least the Post Office authorities complain) the public refuses to realise. Letters can be posted for the Continent at Charing Cross every evening up to 8 P.M., and the public insists on treating Indian letters in the same fashion The result is simply that they lose a week. Not long since an illustrious personage caused considerable difficulty by making this mistake, as a special bag had to be made up to convey his letter. Her Majesty, the writer was informed, not only always sends her letters in good time, but also, with that scrupulous regard for legality which distinguishes her in small as well as in great matters, always stamps her own private letters; a habit in which the servants of the Crown are not always, unless they are maligned, quite so careful to imitate her.

Down to Dover then the sorters have an easy time of it. There are just a few Continental bags to finish off, and the few score late letters that have come from Charing Cross. Few though they be, however, at 4*d.* each letter the Charing Cross late box brings in a nice little income of about £1000 a year. The fee is intentionally made heavy, as the privilege can only be conceded on condition that no large number of persons habitually avail themselves of it. On the return journey the clerks will have to work their hardest, for though the bulk of the inward mails is far from being equal to that despatched outwards, the sorting of them has all to be done after the train leaves Dover. The Ostend letters are due into London at 3.45, but the French mail, which has come jogging along from Paris to Calais at the leisurely rate of

33⅔ miles per hour—a speed which of course is too great for mere second-class mortals—does not leave Dover till 4 o'clock. And not only do Londoners in all parts of the Metropolis expect their letters by 8 o'clock, but the day mail for Ireland, Scotland, and Lancashire leaves Euston at 7.15, and that for the West Riding departs at 7.40 from King's Cross. It is a good morning's work, say the sorters, if they can finish the French and Belgian mail before they get to Cannon Street. The sorting of the residue must be finished at the G.P.O., whither all the letters go in the first instance, unless, indeed, the boat has been delayed, in which case the mails for the North gallop across to Euston and King's Cross as fast as hansom cabs can carry them.

Before we leave the T.P.O., as the officials call it, let us look at the list and see how the 871 bags composing the mail are apportioned among the different destinations. For Bombay, or in other words for India, there are 284 sacks. But Australia has more. Melbourne and Sydney, neck and neck as a rule, on this occasion actually run a dead heat with 105 sacks apiece. Hong-Kong has rather more than half as many; Colombo, Singapore, Adelaide, and Brisbane each receive somewhere between 30 and 40. The remaining 180 sacks are divided in ones and twos and threes, not only amongst the smaller towns of Australia and New Zealand, but over the length and breadth of the Mediterranean and the Indian and Pacific Oceans, from Beyrout and Cyprus down to Mozambique and Delagoa Bay, and eastward as far as Fiji and Yokohama.

Arrived at Dover, the passengers and the Continental mails were transferred forthwith to the ordinary packet, and the Brindisi bags were left in the vans till she was despatched. Then the special boat came alongside immediately and took on board her load, which blocked the whole of the decks on the centre part of the ship below the bridge. In the passage to Calais the present writer, who was of course the only passenger, was able to appreciate to the full the advantages

habitually enjoyed by "distinguished" persons in being free from those sights and sounds which do anything rather than

> Exhilarate the spirit, and restore
> The tone to languid nature.

Reaching the French harbour, we found the "special" awaiting us, the Brindisi passengers already in their through sleeping-car, three of the seven *allèges* already filled with mails, and locked, and *plombées*, and the remainder waiting for their load. The "heartfelt inertia"—to borrow a phrase of Mr. Foxwell's—with which the porters at Calais handled the mail-bags, formed a striking contrast to the alacrity of their compeers at Dover.* As the train moved off, it was satisfactory to think that, though the foreign companies add insult to injury by first making our Post Office pay extortionately for a special train, and then using our special for the conveyance of the mails of almost every other country in Europe, all these countries combined would only be able to muster up some 70 or 80 bags, as against the 800 or 900 despatched from London.

This is, however, about the only point in connection with this train of which an Englishman can think with any approach to satisfaction. The Post Office authorities plume themselves on the fact that the price they pay for their train is now considerably less extortionate than it used to be. And so far they are correct, but I calculate that even on the reduced scale, what with mail subsidy, and the fares and excess fares from the twenty passengers (who are packed like herrings in a barrel into a single sleeping-car, and permitted to use the pantry as a lavatory as soon as the attendant has finished washing the plates and dishes), the Continental railway companies make at least 15*s.* a mile out of this train, or say three times the average earnings of an express in England. In return they forward it at the rate of precisely

* The writer is assured on authority he cannot presume to question that he has maligned the Frenchmen, who "do their work well."

26 miles an hour throughout. It is bad enough to think that this speed can almost be matched across the Atlantic by the 'Umbria' and the 'Etruria,' and across the Channel by the 'Victoria' and the 'Empress'; it is worse still to remember that it is two or three miles an hour slower than the pace at which the half-dozen letters for the fishing villages of Wick or Penzance are sent forward from Newton Abbot and Perth respectively; but it is worst of all to know that "the other expresses, running over this identical course abroad daily, exceed the average speed of this train by 3 miles an hour."*

I questioned an official of the Post Office one day as to why they put up with such scurvy treatment, instead of sending the mails round by Ostend and the St. Gothard, as they had been urged to do by the Belgian authorities. His reply was that there was too much risk of delays owing to fog and stress of weather on the passage to Ostend. An insufficient answer, to my mind. The transfer of the mails to a new route, even if it had implied an occasional delay and an occasional payment to the P. and O. Company for extra coal burnt to make up lost time, would at least have taught the Mediterranean Companies—both the French and the Italian one—not to presume too far upon their natural monopoly. As these pages are passing through the press comes fresh news to show that our Post Office has not secured an over-good bargain. Last summer the stress of competition led the North Western authorities to land in Edinburgh the passengers by the 10 A.M. from Euston in front of those travelling by the train "under contract for the conveyance of Her Majesty's mails" which left at 7.15. And a pale reflection of the brilliancy of the "Race to Edinburgh" seems likely now to be seen in Italy in the shape of a "Race to Rome." The pace over a considerable portion of the Brindisi route has already risen to about 30 miles an hour,

* I quote from Mr. Farrer's forthcoming book on 'European Expresses'—so christened mainly on the *lucus a non* principle—of which he has been so good as to let me see the sheets in advance.

and yet more startling accelerations may be in store for the Italians ere long. But the Indian Mail will still creep from Modane to Piacenza at 22½ miles an hour, unless for very shame the Mediterranean authorities should voluntarily initiate an improvement. If the Post Office must enter into long contracts at all—a course whose wisdom I am reluctantly compelled to presume to question—it should, at all events, in future insert in every contract a stipulation—if not that the mail train should be as fast as any train on the line, at least that its speed should be increased *pari passu* with each increase in the speed of the Company's ordinary trains.

To revert for a moment to the subject of the transfer of baggage from ship to land and *vice versâ*, it is worth notice that the arrangements at Boulogne are nothing short of scandalous. The South Eastern Company does all it can to insure expedition. It puts the luggage at Charing Cross into what are termed "luggage-boxes"—small trucks, that is, whose bodies are slung at Folkestone straight away off their wheels on to the deck of the boat.* But the Nord cannot go to the expense of a crane and special under-frames, so at Boulogne the baggage has to be carried on shore piece by piece. Nor may the profane hands of an English sailor interfere in a task reserved for porters licensed by the Boulogne Chamber of Commerce. If anyone wishes to be convinced that monopolies are demoralising, let him watch how the monopolist porters stand and wait, lest any one of them should reflect upon his neighbours by unseemly and undignified haste, and the pace at which, having at length selected, each man his box, they stroll off with it to the ramshackle luggage-van of the monopolist Chemin de Fer du Nord.†

* At Dover the baggage has to be carried to and from the vessels, as the Company is not permitted to erect cranes upon the Admiralty Pier.

† [I need not repeat here the tale of the phenomenal improvements on the Nord. Its splendid performance of late is almost enough to convert even an Englishman to a belief in monopoly, and quite enough to make him reluctant to compare our own progress at home under the regime of competition. 1899.]

PUTTING BAGGAGE ON BOARD AT FOLKESTONE.

The present writer has no wish to conceal his own opinion that the least meritorious English company would be esteemed a paragon of perfection if it were transferred to France, but in one respect it must be acknowledged that the companies of the South of England fall far short of the French railways, and that is in the important matter of punctuality. Absolute punctuality, of course, must always remain unattainable under English conditions. When a train is timed up to its utmost capacity every day of the week, a delay of five minutes once caused remains irrecoverable. But so long as English people have the good sense to maintain their freedom to arrive at a station at the last moment with a cab-load of luggage, such delays must happen. The Continental system of allowing every day at a station an interval of five minutes, though it may be needed only once a month, and requiring luggage to be delivered ten minutes in advance, avoids delay no doubt, but the game is emphatically not worth the candle.

But habitual unpunctuality is another matter, and there are too many trains in the South of England which only exceptionally perform their work within the time allotted to them in the time-table. Probably, however, the actual amount of unpunctuality is not as great as is commonly supposed. The South Eastern has a reputation for frequent offences in this matter. How far this is true the present writer cannot attempt to judge by personal experience, but this I can say: that one morning, not many months since, I saw quite accidentally a table of the working of all the up trains into London Bridge between 8 and 11 A.M. on the previous five days, that is, of course, at the most crowded time of the day. No train had been more than 6 minutes late, very few were more than 2 or 3, while the great majority were up to time. No doubt there may have been delays afterwards getting into Cannon Street. In all England there is perhaps no more difficult piece of traffic to work. From the nature of things, trains going into Cannon Street from London Bridge must cross the path of trains coming

LANDING BAGGAGE AT BOULOGNE.

out to go to Charing Cross, and *vice versâ*, and it is impossible but that this should cause a difficulty. Add to this the fact that the sides of the triangle on the Surrey side of Cannon Street Bridge are so short that an empty carriage train from Charing Cross to London Bridge direct may quite well block both the entrance to and the exit from Cannon Street entirely, and the further fact that, for all its immense traffic, the South Eastern has practically only one down line,* and then no one need wonder that there are delays at Cannon Street, and that in time of fog the difficulties become simply overwhelming. Whether the directors would be wiser if they accepted the inevitable, and spent a million or so in widening their line, is another question altogether. At present they are widening the bridges both at Charing Cross and Cannon Street, but, after all, a chain is no stronger than its weakest link, and it is useless to enlarge your stations as long as the road into them remains obstructed. If the South Western needs six lines, it is impossible to suppose that the South Eastern can get on permanently with three.

But the immediate access to London is not the only weak point in the South Eastern system. It still works a considerable number of trains over its old main line *viâ* Redhill. We need not attempt to enter into the merits of the conflict with the Brighton Company. Suffice it to say that the ingenious arrangement by which a well-intentioned Legislature set two railway companies to play the noble game of "pat-a-cake"—first a bit of South Eastern, then a bit of Brighton, then another bit of South Eastern, and another bit of Brighton†—has had its natural effects, and the official

* This line enjoys what is, I believe, a unique distinction. It is the only down line in Great Britain which has its up line on the left hand or Continental side. The explanation of this, as of most other English anomalies, is a historical one.

† There are nine lines on the viaduct outside London Bridge. The two roads next the river are South Eastern exclusively. The three furthest in the opposite direction, known as the South London line, are exclusively Brighton—this leaves four in the middle used jointly by the two

relationship between the boards of the two companies has been at times the reverse of cordial. But even apart from the difficulties inseparable from a divided ownership, nothing could enable mere human ability to work the traffic satisfactorily up over the single pair of lines from Redhill to London. Here is the East Croydon programme for two hours of a week-day morning:—

Due in.	Due out.	Company.	Starting-point.	Destination.
9.0	9.4	L. B. & S. C. R.	East Grinstead .	London Bridge.
9.12	pass	S. E. R. . .	Dorking . .	Charing Cross.
9.15	9.17 & 9.25	L. B. & S. C. R.	Tunbridge Wells	Victoria and London Bridge.
9.20	9.21	S. E. R. . .	Caterham . .	Charing Cross.
9.24	9.28	L. B. & S. C. R.	Brighton . .	London Bridge.
9.32	pass	S. E. R. . .	Reading . .	Charing Cross.
9.33	9.42	L. B. & S. C. R.	Oxted . . .	Victoria.
9.35	pass	L. B. & S. C. R.	Brighton . .	London Bridge (Mondays only).
9.38	[slip] 9.42	L. B. & S. C. R.	Brighton . .	London Bridge and Victoria.
9.46	9.48 & 9.50	L. B. & S. C. R.	Hastings . .	London Bridge and Victoria.
9.53	9.54	S. E. R. . .	Oxted . .	Charing Cross.
9.56	9.57	S. E. R. . .	Dorking . .	Charing Cross.
9.59	10.2 & 10 4	L. B. & S. C. R.	Eastbourne . .	London Bridge and Victoria.
10.9	pass	S. E. R. . .	Reading . .	Charing Cross.
10.11	10.12	L. B. & S. C. R.	Tunbridge Wells	London Bridge.
10.13	10.14& 10.19	L. B. & S. C. R.	Tunbridge Wells	Victoria and London Bridge.
10.16	10.17	S. E. R. . .	Caterham . .	Cannon Street.
10.19	10.22& 10.29	L. B. & S. C. R.	Brighton . .	London Bridge and Victoria.
10.26	10.31	L. B. & S. C. R.	Tunbridge Wells	London Bridge.
10.32	10.34& 10.36	L. B. & S. C. R.	Hastings . .	London Bridge and Victoria.
10.41	10.43	L. B. & S. C. R.	Brighton . .	Victoria.
10.45	pass	S. E. R. . .	Aldershot . .	Charing Cross.
10.49	pass	L. B. & S. C. R.	Brighton . .	London Bridge.
10.54	10.57	L. B. & S. C. R.	Worthing . .	London Bridge.

companies. As far as Corbett's Lane, where the Greenwich line joins, these lines are maintained and signalled by the South Eastern; thence to Croydon they are under Brighton management. From Croydon to Redhill there is only an ordinary double line, but a certain variety is imparted by dividing it into two lengths. As far as Coulsdon Junction it is Brighton, thence to Redhill South Eastern again.

It will probably be admitted that this table does not leave much margin for contingencies. It would be tedious but easy to produce an equally remarkable table of the working at the same hours of the trains on the Chatham line through Herne Hill or Blackfriars. The Chatham, too, can never hope to cope successfully with its traffic until it has improved its access to London. Four lines of rail as far as Bickley are at the present moment an absolute necessity for the proper conduct of its business. Before, however, we condemn the Company for not providing them, it is fair to remember that the £100 shares are only worth about £20. Directors naturally shrink from adding £5 to the nominal capital of their line for every £1 they receive to spend on its improvements. On the other hand, to insert fresh preference issues in front of the ordinary stock every time it seems to be coming within measurable distance of a dividend is a scarcely less serious hardship.

What the congestion is on the Chatham and Dover line at the present moment may be judged by two facts: the one, that every great railway company in London, except the Great Eastern, works trains over some portion of it; the other, that three new City termini, to say nothing of its outlets to Moorgate Street and Farringdon Street, have been opened within twenty years. The youngest of all the London railways, the Chatham a quarter of a century back had its terminus at Blackfriars, on the south side of the river. Thence it extended to Ludgate Hill, ten years ago it went a quarter of a mile further to Holborn Viaduct, and in 1886 it expended a sum of three-quarters of a million on a new bridge across the river and a new station abutting on Queen Victoria Street. But even now its accommodation at the busy time of the day, errs, in Aristotelian phrase, rather on the side of deficiency than of excess.

There is one feature of this struggling line of which it is possible to speak in terms of unqualified praise, and that is, its signalling arrangements. In a previous chapter, in tracing

the growth of Waterloo Station, we saw how each possibility of danger, as it had forced itself into notice, had been met by its appropriate antidote in the form of improved mechanical appliances. But there comes a point where signalling apparatus must necessarily fail. No machinery can ever force a man, to whom two courses are open, always to choose the right one. And signalmen, like their neighbours, are fallible. Take a case that has actually occurred from time to time. A man receives a signal from the box in the rear that a train is coming. He gives the "Line clear" signal on the bell, a moment after pegs his instrument over to "Train on line," and then pulls over the lever, which drops the arm on the signal-post outside. His attention is diverted to something else; ten minutes after he looks up; his instrument still shows "Train on line," and his signal is still down. He hesitates a moment, then makes up his mind that the train must have passed while his attention was directed elsewhere; so he puts up his signal again and pegs over his block instrument to "Line clear." Then when next a train is telegraphed to him as coming, he accepts it in the usual manner. But in fact the first train never did pass his box, but broke down before it reached him, and now he is allowing a second train to rush forward upon the top of it.

On the Chatham and Dover there is in use a system, known by the name of its inventor as the Sykes Electric Block. In two lines we may explain its action by saying that it makes it impossible for one signalman to organise a collision without securing the co-operation of his neighbours in the adjoining boxes. Take the case we have just described. Call the first man A, and the man further down the line B. Once A had put up his signal, it would be impossible for him, if the Sykes apparatus were in use, to pull it off again without B's consent. That consent, it is almost inconceivable that B would give, as it is hardly possible that he too would be under the delusion that the train had passed him, when it had really broken down. Without going into the technical details of the invention,

which is in use all over the Chatham and Dover line, we may say that A's signal is locked at danger till it pleases B, in response to a request telegraphed by A, to set in action an electric current which releases the lock. And it should be observed, that if by chance a flash of lightning were to strike the wires and enter the instrument, its only effect would be to lock the signal all the faster. Such an occurrence, that is—and it is by no means an unlikely one—might delay a train but could not endanger its safety. It is, however, just conceivable that B, too, might make a mistake, so Mr. Sykes proposes to provide for this contingency in the following manner: Beyond B's box, on the way towards C, a treadle is inserted on the line itself, and worked by the passing train. Once B has accepted a train from A, not only can A not lower his signal on his own account, but even B cannot give him permission till such time as the train has passed B's box and pressed down the treadle on its way to C.

Let us notice in conclusion one or two more precautions, that have been introduced into the new St. Paul's Station. The "scotches" which prevent carriages standing on the sidings from running out of them and "fouling," as it is termed, the passenger lines, instead of being mere loose logs of wood, that the carelessness of a shunter may forget, or the wheel of a carriage may push to one side, are solid blocks of iron worked by levers from the signal-cabin, and interlocked with the signals. The buffers at the end of the bays are great steel beams 8 feet in length, actuating elaborate hydraulic machinery that gradually takes up and absorbs with the minimum of shock the momentum of a train running too fast into the station.* Collisions have sometimes happened, owing to a train at a terminus being turned

* An illustration of these buffers is given on p. 444. The patentees claim for them that "they are of sufficient power to stop a train of 200 tons weight, moving at six miles an hour, without inconvenience." They add further that if a train should accidentally run in at 12 miles an hour, the shock to the train would be very much reduced, and "no harm would happen *to the buffers*."

by the mistake of a signalman into a line that was already occupied. At St. Paul's, and also at the Crystal Palace, it has been made physically impossible to lower the signal admitting on to a line on which carriages are standing. This has been accomplished in the following manner: One of the rails is insulated and connected to a battery and coil, whose magnetism holds up a bolt that fits a slot on the signal-lever. As long as the rail remains insulated the lever can be worked. But run a carriage on to the insulated rail. The iron axle instantly connects the insulated with the non-insulated rail, the current through the coil is diverted, the magnet loses its force, the bolt drops down into its slot, and the signal is immovably locked at danger.

REIN, STEAM, AND SPEED, EASTERN COUNTIES RAILWAY.

CHAPTER X.

THE GREAT EASTERN RAILWAY.

"On Wednesday last, a respectably dressed young man was seen to go to the Shoreditch terminus of the Eastern Counties Railway and deliberately take a ticket for Cambridge. He has not since been heard of. No motive has been assigned for his rash act." Such was the language in which *Punch*, a generation back, gave utterance to the popular sentiment as to the line which nowadays, having changed both its nature and its name, is known as the Great Eastern; nor is there any reason to suppose the satire to have been one whit more trenchant than was in fact deserved. Certainly it stood by no means alone. "The scapegoat of companies, the pariah of railways, the Eastern Counties," is the phrase employed, without any justification being apparently thought necessary, by Francis in his 'History of the English Railway,' which was published in 1851. It was of the Eastern Counties that the tale was originally told how a ticket collector, expostulating that a strapping lad of sixteen could surely not be entitled to travel half-price, was met by the rejoinder that he was under twelve when the train started. "Even a journey on the Eastern Counties," said Thackeray, "must have an end at last."

A season-ticket holder at Cheshunt, finding his griefs too deep for words, endeavoured to assuage them, and at the same time shame the Company into more decent courses, by publishing a whole long string of skits and cartoons. It was his custom to arm himself with a large bundle of papers, and taking his seat in the front carriage of the train, to fling them out broadcast among the passengers waiting at each platform. But the passengers rushed forward to receive them with such avidity, that he was forced to abandon this practice for fear that someone should be pushed off the platform under the wheels of the train. The series, as it now lies before me, consists of about twenty numbers. Their date is 1856. The first reproduces a challenge supposed to have been sent by a Bethnal Green costermonger—Hoy by name—to race the train with his donkey and barrow, and represents the contest, in which, needless to say, the railway is not victorious. Subsequently, the donkey is in front, towing the train, amid the applause of the passengers, grateful for such unusual celerity. In another number, readers are invited to contrast the speed and cheapness of the South Eastern with the treatment to which they are accustomed at the hands of the Eastern Counties. Finally, the series concludes with a picture of the Bishopsgate Station, with a statue of the donkey in front of it, aloft upon a pedestal, as a fit emblem of the line.

If anything had been needed to heighten the deep dissatisfaction of the public with the Company's performances, it would have been supplied by the contrast with the magnificent promises that were made at the opening of the line. At the first general meeting held in 1836, the Chairman concluded his speech in these words: "Most cheering it is, gentlemen, to reflect that from the various sources I have indicated, from the vast passenger traffic in particular, you have every reason to reckon with confidence on an ample return for your capital; while at the same time you know that your enterprise rests on the broad and stable basis of national utility." But the Chairman's speech was only luke-

warm, when compared with the glowing enthusiasm of his proprietary. One gentleman spoke of "the long vista of future advantages, such as never before entered into our mind and calculations," that was opening up before his rapt and prophetic gaze. "We are now told," he says, "that there are six great branches in contemplation—nay, something more than in contemplation, almost in actual progress; they may be likened to six columns for the adornment of our railway, built without expense to us, yet certain of being a great and abiding source of profit to the undertaking. Opening up, as this railway will do, the great marts of the Continent, what can be expected but an enormous profit for the shareholders, while at the same time a lasting benefit is conferred on the country?" What this enormous profit was likely to be, was described by another shareholder, a gentleman "who by his speech proved himself not merely a philanthropist but a sound philosopher." "The report," said Mr. Evans, "is most satisfactory, and I think the prospects held out to us in it are by no means overcharged. If this undertaking fails in producing the dividend of 22 per cent. calculated upon in the report, then, I must say, human calculations and expectations can no longer be depended upon. . . . Should I live to see the completion of this and other similar undertakings, I do believe I shall live to see misery almost banished from the earth. From the love I bear my species, I trust that I may not be too sanguine, and that I may yet witness the happy end that I have pictured to myself."

But alas!

> The best-laid schemes o' mice an' men
> Gang aft a-gley;

and human calculations and expectations once more proved fallacious. After a few years, during which indeed the Company paid—though it can hardly be said to have earned—a dividend, came the crash of 1848, and Eastern Counties affairs fell into a slough of despond, whence the efforts of its Chairman, George Hudson, M.P., with all the "King's"

horses and all the "King's" men, by no means prevailed to extricate them. Drawing a decent veil over the failure of this philanthropic and philosophic attempt to banish misery from the earth, and saying as little as possible of inconvenient incidents, such as the seizure of the rolling stock in Shoreditch Station for debt,* let us pass on to the year 1862, which saw the amalgamation of the Eastern Counties, Eastern Union, East Anglian, Norfolk, and East Suffolk, under the style and title of the Great Eastern. Five years later the new Company was again in difficulties, and Lord Cranborne, who was to become Lord Salisbury in the course of the same year, consented to accept the post of Chairman.

With Lord Salisbury's advent, the new era may be said to have dawned, but the first beginnings of his reign were scarcely auspicious. The Company applied to Parliament in 1867 for powers to raise £1,500,000 of capital as the least sum that could extricate them from their most pressing embarrassments. Their application was refused; so they amended their Bill, asked for £3,000,000, and got it. The claims of public life compelled Lord Salisbury to retire in 1872, and after a short interval, during which the disastrous Thorpe accident had called attention to the fact that a good deal of the Company's equipment was still, in Mr. Foxwell's phrase, in a state of ludicrous inefficiency, he was succeeded by the present Chairman. This gentleman's name may perhaps go down to posterity in Parkeston Quay, which seems likely to treat Harwich as the new Sarum of the church in the valley has treated the older Sarum of the castle on the hill; but to the inhabitants of East Anglia who know what their railway service was, and see what it is, and remember that

* This was a frequent experience in the early days of railways, and occurred to the Brighton Company at a much more recent date. The seizure of rolling stock is now, however, prohibited by Act of Parliament. But a somewhat similar thing happened, no longer ago than the summer of 1887. A small local line was announced to be opened in Lancashire, and the day before the event the contractor, whose accounts had not been settled, pulled up the junction with the neighbouring line of the Lancashire and Yorkshire, and put back one of his own engines to keep possession.

the change has been brought about, in the face of unexampled agricultural and commercial depression, by a struggling Company, whose proprietors have never received more than 2½ per cent. for their money, he should need no monument, unless it be one inscribed with the words written on the tomb of Wren, *Si monumentum quæris, circumspice.*

With the opening of Liverpool Street Station in November,

PARKESTON QUAY.

1875, the modern history of the Great Eastern begins. As ill luck would have it, the contracts for the construction were let just at the time when iron was at famine price. There is a deal of ironwork at Liverpool Street, and its price was between £16 and £17 a ton, so the unfortunate shareholders had to go without a dividend for a year or two. The station cost well over £2,000,000 sterling, and when it was first built everybody looked upon it as a white elephant of the very largest size, and asked wherever the traffic to justify

such a terminus was expected to come from. But within ten years the traffic had grown at such a rate that the station was already inadequate. As long ago as 1884 the Chairman told his proprietors that, if they only could work a thousand trains a day in and out of the station, they could fill them all, but that the present station and its approaches would not afford room for more than about two-thirds of that number.

Since then the Company has been buying up property on the west side of Bishopsgate Street Without, as opportunity has offered; last session it obtained powers for the compulsory purchase of the whole block between the station and the street; and now the shareholders' sanction has been given to a scheme for raising the necessary funds. The estimated expenditure of about another million—one-third for works and two-thirds for land—will give the Company not only a large addition to the present area of the station, but also a third pair of rails into it from Bethnal Green Junction, making six in all. They will then have unquestionably the finest and most convenient station in London. On the east side will be the suburban lines going out by Stratford down the river; on the west, the suburban lines to the north,—Enfield, Tottenham, Walthamstow, and so forth; while in the centre the main line traffic will flow up and down, unencumbered by the local and stopping trains.

For indeed, year by year, the Great Eastern through traffic is growing in importance; year by year the trains are becoming not only faster and more numerous, but longer and heavier. And to check a seaside express with "twenty on" on the bank of 1 in 70 outside Liverpool Street is a serious matter. If there is one thing on which the Great Eastern prides itself more than another, it is its clockwork punctuality, and punctuality is impossible when traffic is overcrowded; but of this more anon. The Great Eastern through trains have an individuality of their own. The 10.25 A.M. or the 4 P.M. Yarmouth trains may be considered to be the one extreme of the railway social scale, of which

the 7.55 P.M. special Highland express from Euston represents the other. The latter train is made up of sleeping saloons and family carriages, with an occasional third-class: the former is a succession of third-class coaches, with stray first or second-class compartments interjected at long intervals, and even these usually empty. But what the Great Eastern lacks in quality, it makes up in quantity. A North Western train with 300 passengers would be uncommonly well filled. The Great Eastern thinks nothing of 500: and even 600 and 700 are far from unknown.*

And certainly it caters for the convenience of its numerous customers with a generous hand. It would of course be absurd to look here for speed such as is to be found on the road to Manchester, still more absurd to expect anything comparable to the phenomenal performances to Edinburgh at which all the world wondered last summer. But, taking all the circumstances into consideration, the number of places of something like equal importance served off the same train and the consequent profusion of through carriages, the swing bridges near Yarmouth and Lowestoft, and the congested state of the traffic at the London end of the journey, the best of the seaside trains would be a credit to any company. Several of them, both up and down, cover the 68¾ miles between London and Ipswich without a stop in from 92 to 95 minutes, while the services to Yarmouth (121¾ miles in 3 hours 15 minutes) and Lowestoft (117¾ miles in 3 hours 10 minutes) fall but very slightly short of 40 miles an hour throughout.† Nor can Clacton, Felixstowe, Dovercourt, or

* It should be said that most of the trains described here only exist for the three or four summer months. The text gives the position of affairs in 1888. Doubtless the summer of 1889 will see them revised and still further improved. Here are two other instances of the position the Company has taken up as the poor man's line. Its cloak-room charge is 1*d.* instead of the elsewhere universal 2*d.*, and the charge for attendance at the hotel at Parkeston—an extremely comfortable hotel it is too—is only 1*s.* Straws, no doubt, but they are of use to show the direction of the wind.

† [The best times are now: Ipswich, 88 minutes; Yarmouth, 2 hours 50 minutes; Lowestoft, 2 hours 48 minutes. 1899.]

Aldeburgh, all of which get through carriages several times a day from Liverpool Street, complain of the train service that by its general thoughtfulness and convenience has, in the course of a few years, elevated these little seaside villages to the rank of recognised watering-places.*

Even Wells-next-the-Sea—it would probably puzzle most of my readers to say what particular bit of sea it is that Wells is next to—has a through carriage twice a day from Liverpool Street, and once in addition on the 12.5 P.M. from St. Pancras. But better than all these is the service to Cromer and to Lynn and Hunstanton. And thereby hangs a tale, and the

* Between Lowestoft and Aldeburgh is the little watering-place of Southwold, and Southwold gets no through carriages, not because its railway belongs, which it does, to an independent company, but because that company was short-sighted enough to construct it as a narrow-gauge (3 feet 6 inches) line. Probably there are not many people nowadays who remember that the Great Eastern itself, as far at least as Chelmsford and Cambridge, was originally constructed on the 5 ft. gauge—"Mr. Braithwaite, the engineer, being of opinion"—so his evidence before the Gauge Commission of 1845 is summarised by Mr. Smiles—"that an increase of three and a half inches in the width of his line would give him better space for the machinery of his locomotive. But when the northern and eastern extension of the same line was formed, which was to work into the narrow-gauge system of the Midland Railway, Mr. Robert Stephenson, its new engineer, strongly recommended the directors of the Eastern Counties line to alter their gauge accordingly for the purpose of securing uniformity; and they wisely adopted his recommendation. Mr. Braithwaite himself afterwards justified the wisdom of this step, and stated that he considered the narrow-gauge 'infinitely superior to any other,' more especially for passenger traffic." The work of closing in was begun in August, 1844, and finished on the 5th of the following October. The change was announced in the following circular:—

"EASTERN COUNTIES RAILWAY.—Colchester and Cambridge Lines.

"The Directors have to announce that the change of gauge with the consequent alteration of the engines and carrying stock, which has been proceeded with for the last month throughout both lines, will be completed on Monday next, when the trains will run with their accustomed regularity; and the Directors in expressing their regret that the public have been necessarily inconvenienced during the progress of this important work by occasional delays, have at the same time the satisfaction to state that the passenger traffic on the main line has not for a single day been stopped, and that without the slightest accident having occurred.

"Offices, London Terminus, October 4th, 1844."

tale is instructive as showing that even the most virtuous and well-disposed of companies is none the worse for a moderate dose of that most wholesome of tonics, competition.

If anyone will look at Airey's Railway Map of England, he will observe that, from Southend to Lynn, and from Cambridge to Lowestoft, the whole of East Anglia is, except for some insignificant local lines, such as the Colne Valley or the Southwold Railway, given up to the magenta-coloured lines of the Great Eastern system. In the north of Norfolk, however, there is an important exception. The Eastern and Midlands Railway, a line which makes up in energy what it lacks in capital, runs due east and west from Lynn to Melton Constable.* Thence, like the River of Eden of old, it is parted, and becomes three heads The first goes off north to the sea-coast, and bending eastwards terminates at Cromer; the second runs south-east between the "Broads" and the sea to Yarmouth; the third turns south to Norwich. At Lynn, the Eastern and Midlands connects, both *viâ* Spalding and *viâ* Wisbech and Peterborough, with the whole of the Great Northern and the Midland systems.

To Cromer, therefore, it has a chance of competing for the London traffic—a possibility of which last August it availed itself to the uttermost, though its road is 160 as against 139 miles, and more than half of it over single line; while if its route is too roundabout to affect the London traffic to Yarmouth or Norwich, it is in better case in competing for traffic coming to those towns from the Midlands or the North of England. To Cromer accordingly the Great Eastern is on its mettle. London 1.20, Cromer (1800 inhabitants) 4.50, is a laconic statement of fact that is more eloquent than pages of panegyric.† This is only a slight improvement on the time-table of 1887, but there is one improvement that deserves fuller notice in this connection. In that year, passengers

* [Now the joint property of the Midland and Great Northern Railways. 1899.]

† [London 1.30, Cromer 4.25, is the record in 1899.]

coming up from Cromer in the morning—except Mondays, when there was a good train, but at the unfashionable hour of 6.30 A.M.—left at 9 o'clock and only reached town at 2.10 P.M. But *viâ* Eastern and Midlands they could leave at 8, and reach King's Cross at 1 o'clock. This year accordingly the Great Eastern took warning. A new train left Cromer at 8 A.M., caught an express at Norwich, and was in London at 11.38.*

But the Eastern and Midlands trains are themselves so creditable that they deserve to be mentioned for their own sakes, and not merely as a stimulus to their powerful neighbour. During the summer, passengers left King's Cross in a slip coach attached to the 2 P.M. Manchester express, which, though now shorn of its glory as quite the fastest train in the world, still is booked to run at the rate of 54 miles an hour, and often actually covers its 60 miles in 60 minutes, and were dropped at Peterborough at 3.25. After waiting 20 minutes, in order to form a connection with the up Manchester express due at 3.38, the Cromer carriages started off again at 3.45 over their 84 miles of single line, and reached South Lynn, 37¼ miles distant, at 4.48. This sounds little enough, but in the interval the train had not only to call at Wisbech and Sutton Bridge to take up and set down passengers, but also to slacken speed to a walking pace in order to pick up or hand out no less than ten different train-staffs.† From Lynn it covered the 47 remaining miles in 99 minutes, or roughly speaking, at the rate of 29 miles an hour, including three advertised stoppages, and three others noted as to be made if required.

* The Cromer Station of the Great Eastern has recently been described as the most beautifully situated station in England, and though several Cornish stations, St. Ives more especially, run it hard, and Robin Hood's Bay and Coniston might have something to say for themselves, I am not prepared to dispute its claim to the title.

† A friend, who is not an authority on railways, wrote to me recently: "There is a curious block system in vogue here: a train nominally runs through Mary Tavy; practically, it crawls through at a walk, and station-master and engine-driver exchange bits of wood."

We spoke a few lines back of stoppages for "train-staff" purposes. Most people probably know that single lines are commonly worked on what is known as the "staff and ticket" system. Each section of the line, that is, has its own staff, in size usually much like a policeman's truncheon, square, round, or triangular, blue, green, red, or yellow, as the case may be, to avoid all risk of the staff for section A to B being mistaken for that belonging to section B to C. In strict theory no train should pass over a section, unless the staff belonging to that section is in possession of the driver. But it must often happen that, when a train from A gets to B there is no train ready to come back from B to A, while there may be a second at A, waiting to come on to B. So in practice the staff is supplemented by tickets. No engine-driver may leave A for B till he has seen the staff belonging to the section in the possession of the A station-master, but having seen the staff he may accept a ticket and go on, leaving the staff to come by a subsequent train. Till the staff does actually reach B, of course no train may be despatched in the opposite direction.

To this system, which is in use on almost all the single lines all over the country, there are two objections. The one, mainly perhaps theoretical, that a station-master may give, and a driver accept a ticket, when the staff is not really at the station at all. This risk is almost entirely obviated by an improved form of staff, in which the tickets are of brass, and locked into a hole in the staff itself, so that they cannot be issued unless the staff is on the spot. But there is a more serious practical difficulty. Train No. 1 is sent off from A to B (say, seven miles off) with a ticket; No. 2 should follow immediately with the staff. But No. 2 breaks down or is delayed before it reaches A, and then the whole of the traffic in the opposite direction is kept back at B, because the staff that is wanted there has been left at A.* For to allow the regulations to be relaxed for the

* On some of the Welsh lines it is an every-day occurrence for the staff to have to be sent across country on horseback.

sake merely of avoiding delay, would be to encourage the officials to think lightly of precautions on which, in the interests of the public safety, it is impossible too rigidly to insist.

On the Eastern and Midlands the whole difficulty has been got over by the adoption of a new system, which is in use also on the Somerset and Dorset line, as well as on many of the single lines in Scotland. Needless to say, electricity is the solvent employed. Tyer's Electric Tablet System may be briefly described as follows: Dealing only with a single section of line, for of course the arrangement is the same throughout, we may say that at A there is a box containing, perhaps, a dozen tablets—they look much like quoits—belonging to the section A to B. Eight more, making twenty in all, are in a corresponding box at B. The signalman at A holds the key that unlocks the box at B, while B in return has the key to the box at A. Now imagine a train at A ready to start for B. All the twenty tablets are safe in their boxes, as the line has been closed since the previous evening. A calls to B through the telegraph, B unlocks A's box, A takes out one tablet—for, like the tablets of butterscotch that solace our enforced leisure at stations on the "Underground," they can only be got out one at a time—hands it to the driver, and away the train goes to B.

Arrived there, the driver surrenders his tablet, and gets in exchange one for the next section, which we may call B, C. But let us confine our attention to the section A, B. The signalman at B, having received the tablet, puts it immediately into his box. This done, he can either on the one hand take out a new tablet, and so—assuming A's permission to have been given—send a train back to A directly, or, on the other hand, he can release the lock on B's box and so allow B to send on a second train to him. For the electric locking is so arranged that it is impossible for more than one tablet belonging to the pair of boxes to be out at the same time. You may go on sending trains from A to B, one after another till the whole of the twelve

tablets have been exhausted, and then change and send twenty trains in succession from B to A, but to get two trains on to the same section at the same time is an absolute impossibility —unless of course an engine runs away, or a driver deliberately sets his instructions at defiance. Which latter supposition—if we may avail ourselves of the combined wisdom of Euclid and the Latin Grammar: seeing that, my life is dear to me, thine to thee—is absurd.*

But we must return to Yarmouth and its cheap trippers, who little know the elaborate precautions that are taken for their safety. Thanks partly to the general liberality of tone of the Great Eastern, partly, no doubt, to the Eastern and Midlands competition aforesaid, Yarmouth has probably better through connections than any town of its size in Great Britain. Here is the outline of what is, perhaps, as complicated a piece of marshalling as could easily be found. The 10 A.M. leaves Lowestoft with carriages for Peterborough and for St. Pancras *viâ* Norwich. Ten minutes later a train leaves Yarmouth, with carriages for Doncaster; Manchester *viâ* Lincoln and Retford; Leicester *viâ* Ely, Peterborough, and the Midland; Wolverhampton *viâ* Peterborough, Market Harborough, Rugby, and Birmingham; and finally Liverpool Street. Half-way to Norwich, at Reedham, these two trains join, and leave again in two trains, the first for the Midlands and the North, the second for London. At Norwich the second portion takes on, in addition, some carriages from Cromer, and then follows close behind the first train all the way to Ely.

All that has happened hitherto is child's play to what

* The Eastern and Midlands deserves mention for another feature—the ingenuity with which it has christened its stations. "Cromer, Beach," and "Norwich, City," sound much more attractive than plain Norwich or Cromer. Sometimes, however, it carries the practice to lengths that are questionable. At North Walsham its station is nearer than that of the Great Eastern to the heart of that busy emporium, by precisely the width of the railway platforms. But, for all that, the name is unhesitatingly announced to be "North Walsham Town."

then takes place. At Ely there arrive, within an interval of about twenty minutes, in addition to these two trains from the East Coast, trains from London, from Lynn and Hunstanton, from Doncaster, from Ipswich, Bury St. Edmunds, and Newmarket, and from Peterborough. In the course of a short half-hour everything gets itself re-sorted somehow, though the unprotected female, who, in response to her inquiries how she is to get to Peterborough, is told, "Take the second train after this, and it comes on be'ind," does not seem quite satisfied that it will all end happily; and by 1.45 two trains are careering away to London (for Liverpool Street and St. Pancras respectively), a third to Doncaster, a fourth to Peterborough, a fifth to Lynn, a sixth to Newmarket, *en route* to Ipswich and Colchester, and a seventh, which has never entered Ely Station at all, to Norwich on its way to Yarmouth and Lowestoft.

The Lynn trains, by the way, are rather a curiosity. As mentioned above, the Eastern and Midlands are now seriously competing to Lynn, so the Great Eastern this year began to cover their 98¼ miles from London in under 2½ hours. Having got so far, they apparently thought that Hunstanton, a rising little place, might as well have a lift too, so they run one train there in exactly three hours. The North Western advertise as a "Birmingham Express" a train that takes just five minutes less over its journey. And Birmingham is not only half a mile nearer London, but also a more important place than Hunstanton. But we have lingered too long in these parts and must hasten back to London.

Before doing so, let us just notice two points, and the first must be the admirable cross-country service to Harwich. There are few places in the north and north-east of England whose traffic cannot be tapped at Doncaster, and every afternoon at 4.48, as soon as the East Coast expresses have deposited the passengers from their slip coaches, an express train starts thence direct for Harwich. That it has a right

to the title of express the present writer can testify from personal experience a short time back, when it covered 29 consecutive miles in 9 seconds over the 29 minutes. At Lincoln it picks up a carriage from Sheffield and Manchester; at March another from Rugby and Peterborough. It is often said—and ten years ago the charge may have been on the whole true—that our cross-country services in England are behind those of the Continent: but 'Edinburgh *viâ* Carlisle depart 10, Ipswich arrive 8.58"—450 miles in under 11 hours—is a cross-country connection that would only be possible in England.*

One point more. The Great Eastern has just one little ewe lamb of high-class traffic, the racing specials to Newmarket. A train of sixteen coaches, first-class only, with say 250 passengers at ordinary fares, is a thing that the soul of the traffic manager longs for. But he is seldom gratified, and on the Great Eastern even less frequently than elsewhere. But such things do happen, when the Guineas or the Cambridgeshire are being run for on the Heath. And this special traffic is worked with the utmost difficulty, owing to the utter inadequacy of Cambridge Station. Most people probably know the place, with its single platform a third of a mile in length, and so narrow that the most insinuating of porters can hardly succeed in piloting a luggage-barrow between the roof-pillars and the legs of the passengers. From Carlisle and Kilmarnock to Slough and

* Unquestionably the best Continental long-distance express is the 'Luxe' train to Bordeaux. The time is 8 hours 32 minutes: the distance, 364 miles. The second best is the Bordeaux 'Rapide' (needless to say, first-class only) in 9 hours 15 minutes. [These times have now been brought down to 6 hours 42 minutes and 7 hours 5 minutes respectively. And Bordeaux-Cette, 300 miles in 7 hours, is fully equal to the Edinburgh-Ipswich performance. 1899.]

The size of their country prevents the Dutch from showing what they could do in this line; but Rotterdam depart 9 A.M., Amsterdam arrive 10.10 A.M., 53½ miles in 70 minutes, or at the rate of 46 miles an hour—running through the Hague, the capital of the country, without stopping, and carrying third-class passengers—is a service that would be bad to beat even in Lancashire itself.

Bristol, these old-fashioned single platforms have been disappearing all over the country for years past. Cambridge remains almost alone.

Not but that the Company has done its utmost to get rid of it. A year or two back Parliamentary powers were sought for the construction of a new station at a cost of £130,000. The dangerous level-crossing, at present quite unavoidable, was to be abolished, but unfortunately, in order to straighten the present sharp curve on to the Newmarket line, it was necessary to take a small corner off the adjacent common. The Company was quite ready to buy land of equal value and amount on the further side and throw it into the common in lieu of what was taken. But the very words "encroachment on commons" are as a red rag to John Bull in his present mood; inhabitants of Cambridge protested and petitioned, and the House of Commons threw out the Bill. Since then matters have been at a dead-lock. If, say the Company, Cambridge likes its station, by all means let it keep it; we have plenty of other uses for the £130,000. Still the passengers along the line, who would not have had to find the money, and would not have missed the scrap of common, have certainly no reason to congratulate themselves on the result.

But let us come back to London—it is only a journey of 75 minutes by the best train. In a previous chapter, in sketching the characteristics of the South Western Railway, we noted that it had more trains in and out of Waterloo in the day than were dealt with at any station in London. But the Great Eastern runs it very close. There are 642 trains a day in and out of Liverpool Street as against about 700 at Waterloo.* And in addition the Great Eastern works another 400 to Fenchurch Street, a station which it leases from the semi-defunct Blackwall Railway Company, and uses

* There are 732 trains, empties, light engines, &c., all told, out of Broad Street Station in the 24 hours, but none of these are main-line trains, with their complications of luggage, horse-boxes, and so forth. One of the very busiest stations in Great Britain, and, I believe, the largest—for its glass

jointly with the London, Tilbury and Southend. The Blackwall Company, perhaps, would be more accurately described as being in a state of suspended animation, as it will resume possession of its property at the expiration of a lease of 999 years. Meanwhile, its directors meet twice a year to receive the fixed rent guaranteed by the Great Eastern, solemnly to declare a dividend thereon, and then, so at least it is rumoured, to dine together after their labours in a modest edifice, a relic of their original station-house, still standing on the line just outside the present Fenchurch Street Station.

There may be a question between Great Eastern and South Western as to the number of trains; there is at least no doubt as to the number of passengers. For the year 1885, according to one of Mr. Jeans's tables, the South Western carried 34 millions, as against 65 millions on the Great Eastern. This latter figure is 10 millions more than all the passengers on the North Western, 15 millions more than all the passengers on the Great Western, and almost exactly equal to those on the South Eastern and Brighton put together. Let no one, unless he has stood on the bridge at Liverpool Street, say, at 9 o'clock in the morning or 6 o'clock in the evening, ever suppose he knows what suburban traffic really can be. But the Great Eastern suburban traffic is not only the largest but the most rapidly increasing. Within the last ten years, so Mr. Parkes told his shareholders the other day, the passenger receipts of their line have increased by a sum of £500,000 per annum, and the bulk of this is due to the growth of the London local traffic. As we have already seen, even now it overtaxes the station accommodation at Liverpool Street.

But this is not the only—indeed it is not the chief—

roof covers 11½ acres, or nearly three times the area of the great shed at St. Pancras—is New Street, Birmingham. About 600 trains pass through it in the course of a day, and considering that the station is approached through tunnels at either end, the traffic must be at least as difficult to manage as at any London terminus. [I believe Waterloo and Liverpool Street nowadays 'tie' with about 1000 trains apiece. 1899.]

difficulty. A railway manager in dealing with local traffic is perpetually drawn in opposite directions. On the one hand he is anxious to induce his passengers to live as far out as possible; for in this way he not only gets as large a district as possible from which to draw custom, but also he can fairly charge higher rates to each individual passenger. On the other hand, residential traffic from stations 18 or 20 miles off implies expresses running through the nearer local stations to the terminus, and no one needs to be told that the running of trains at varying rates of speed diminishes enormously the carrying capacity of a line. The Metropolitan Railway can work trains every three minutes in either direction all day long, with no more difficulty than if the trains were so many horses fixed upon a steam merry-go-round. A through line needs very careful management to enable it to carry one-third of that number. And the attempt to fit in additional trains with inadequate margins for contingencies on either side of them simply means the sacrifice of punctuality, and "upon punctuality," to quote the Chairman once more, "depends the line for business purposes." *

And, as we have already said, the Great Eastern officials pride themselves not a little upon their reputation for punctuality, and with good reason. Letters from time to time appear in the papers, complaining that the 9.7 A.M. into Blank Terminus was yesterday twenty-five minutes late "as usual." But the blank is never filled in with the name of Liverpool Street. It is possible to bring this question to a test more definite than mere public opinion—that of actual figures. According to an admirable custom, that ought to be adopted by every railway in England, the

* At Liverpool Street a custom, universal in the North of England but unusual in the South, is adopted, and clock-faces with movable hands indicate the hour of departure of the different services of suburban trains. But an irascible old gentleman collected a crowd round him the other day while he declaimed that, whatever the Company might do, it was impossible for the passengers to be in time for the trains if all the station clocks were different.

time of every train is abstracted month by month and the percentage of unpunctuality carefully worked out.* And here in brief is the result. Out of 110,000 trains run in the half-year ending June 30th, 1888, 60,000 were punctual to the moment; 42,000 less than 5 minutes late; 5 per cent. more were less than 10 minutes; while only 3 per cent. of the total were more than ten minutes late. And this half-year included, be it remembered, three days (or say 2 per cent. of all the working days) in which a dense fog made punctual working an absolute impossibility. For important as punctuality is, the claims of safety are yet more imperative.

This record, however, hardly does the Company full justice, for it includes the long-distance trains all over the line, but does not include the "shuttle" trains on the suburban lines, which, as one of the officials remarked, "must be punctual, as, if they once got wrong, we should never get them right again the entire day." Here is a second table, this time of the trains entering Liverpool Street between 8.30 and 10.30 A.M., the "bread-and-butter" trains, as they are sometimes called. They numbered 7,498, and of these 52½ per cent. were absolutely punctual, and 35½ per cent. either one or two minutes late. Deduct 8½ per cent. more, whose arrival was delayed between 2 and 5 minutes, and 1½ per cent. between 5 and 10, and there remain in the half-year only 123 trains that were more than 10 minutes behind their time. The record of Fenchurch Street is slightly better throughout than that of Liverpool Street. Certainly the industrious apprentice may go and

* An official on another line writes to me with reference to this point: "I should imagine that on every *well-regulated* railway a similar analysis is forthcoming every month as regularly as clockwork." The italics are mine, but contain, I think, the gist of the matter. Assuredly, if similar returns are prepared on all the lines in England, there is a deal of unnecessary expenditure incurred for clerkage. For that the returns are pigeon-holed unread, is proved by the fact that, month after month, tables are published with trains booked at times which they not only do not but cannot keep.

live on the Great Eastern and make his conscience easy as to the probability of his being dismissed for unpunctuality. *

But even without cutting out the intermediate stops, it is possible sometimes to do something to accelerate suburban services, by starting the trains from the station at full speed, running fast up to the next platform, and then stopping as short as possible. This method is, however, by no means economical. One of the most important of the Great Eastern suburban lines is that to Enfield. Enfield is $10\frac{3}{4}$ miles from Liverpool Street, and though there are no less than 14 intermediate stations at which the train calls, the whole distance is covered in 46 minutes. But to do this the engines burn some 45 lbs. of coal per mile, while to run the same train through at 40 miles an hour they would probably burn less than 30. And let no one suppose a few pounds of coal more or less do not matter. Here is a recent calculation on the subject. Great Eastern trains run some 16,000,000 miles per annum, and a saving of 3 lbs. per mile on this mileage, supposing it to be possible, would equal about 22,000 tons, or at 10*s.* per ton—the actual price paid by the Great Eastern Railway is 9*s.* $9\frac{3}{4}$*d.*—an economy of £11,000 a year. But this is not all; the coal has to be fetched from Doncaster, and Doncaster by the Great Eastern road is distant 180 miles from London. To fetch it, there

* Here is the Great Western record for the same half-year:—

Total number of trains run	292,975
To time, $70\frac{3}{4}$ per cent., or	207,083
1 to 5 minutes late, $19\frac{1}{2}$ per cent., or	57,221
6 to 10 ,, ,, $6\frac{1}{4}$,,	18,063
Over 10 ,, ,, $3\frac{1}{2}$,,	10,608

In making a comparison, it ought in fairness to be remembered that if the Great Western has a much less crowded line, on the other hand it has a much larger proportion of long—I might say, of very long—distance traffic. For my own part, while not prepared to admit that the percentage of unpunctuality all over the country is at all as great as is commonly supposed, I am firmly persuaded that it might be, and ought to be, much less. If every company were required to make a return to the Board of Trade, such as is here given voluntarily by two great companies, public opinion could probably be trusted to do the rest.

would be needed 2,960 waggons, or 84 trains of 35 trucks apiece, and the same number of empty trains would have to go back again. The mere carriage of these additional 3 lbs. of coal would cost the Company £1795 10*s.* annually. No wonder locomotive superintendents look sharply after their coal bills.

The Enfield line has another speciality in addition to its capacities of coal consumption. It is probably the most important working men's line in the world. When the Company obtained the powers to construct its metropolitan extensions, it came under Parliamentary obligations, as most other London lines have done either before or since, to run trains at cheap fares for the benefit of the workmen whom it had displaced. About five years ago, Major Marindin was desired by the Board of Trade to inquire how far the companies had complied with these obligations. And in reference to the Great Eastern he reported that they were bound by law to run five workmen's trains a day with a total mileage of 25 miles, but that in fact they were running 23 trains with a mileage of 117¼. This year the number of trains has increased to 30 and the mileage to 164¼, and by any one of these trains we may say roughly that a man can come into his work in the morning about 6 or 7 o'clock, and go back home at his own time in the evening, for a return fare of twopence, or on the average a sixth or an eighth of a penny per mile. Question a Great Eastern official as to whether these extraordinarily low rates actually pay, that the Company is ready to go so far beyond its legal obligations, and he will reply somewhat as follows: "Well, no, perhaps. Directly they only just pay their working expenses, but indirectly they pay us. The workmen's wives and families, and the tradesmen who serve them, travel up and down the line at ordinary fares, and then we get the food that they eat, and the clothes that they wear, and the coal that they burn, to carry to them. You can't settle a great population down in a place without finding employment for the railway that

serves it." Certainly, whether or no the arrangement suits the Company, it at least appears to suit the British working man, for the Great Eastern issues over four million workmen's return tickets in the twelvemonth. But unfortunately it takes a great many twopences to pay a dividend on £40,000,000 of capital.

Complaints are often made in the newspapers that these trains are scandalously overcrowded. Overcrowded they certainly are, and apparently are likely to continue to be Whether it is a scandal is another question, a question that, as the same considerations apply to a great deal of local traffic on other lines, and at all times of the day, is, perhaps, worth a few moments' attention. There is, let us say, taking an instance that will be familiar to most of us, an exhibition at South Kensington, and 20,000 people want to get home directly after it closes at night. How can the Company prevent overcrowding? It already runs trains, each of them as long as the platform can accommodate, as closely following one another as the maintenance of the block system will permit. What more can it do? The trains at 9.30 were empty; the trains at 10.30 will be empty again: but that does not relieve the pressure for the intervening hour. On the Continent the matter would be settled in a simple manner, nobody would be allowed to get in after the train was full; but would English people, as a rule, consider it worth waiting half an hour in order to avoid two or three minutes' discomfort? Anyone who thinks so has the remedy in his own hands. He need only retire to the back of the platform, and possess his soul in patience till the rush has subsided.

Major Marindin, after suggesting various palliatives, sums up as follows: "Whatever may be done, I do not think that overcrowding can be altogether avoided. Wet weather, the unpunctuality of even one train, the unwillingness of passengers to wait, if only for five minutes, the fact that a large proportion of workmen commence work at about the same hour, and the curious anxiety to get into the front carriages,

or into those nearest to the exits, which is observed on nearly all the lines, are causes of overcrowding, which the companies could never entirely overcome, without resorting to steps which would cause great discontent, and still greater inconvenience." The Inspecting Officer might have added one cause more, that whatever be the hour fixed for the last workmen's train, that train will be crowded by persons who, though not workmen, and not obliged to reach London at any very early hour, yet prefer to avail themselves of the cheap fares, being at the same time resolved to reduce their enforced wait to a minimum.

To see the workmen's traffic in full swing it is necessary to go to Liverpool Street about half-past six in the morning,* when three trains from Enfield come in within the space of ten minutes, so it is safe to assume that most of my readers will live and die without seeing them; but no one who is interested in railway working should fail to see another piece of traffic of a somewhat similar nature, that to and from Epping Forest on a fine Bank Holiday. Last Whit Monday the Great Eastern Railway booked over 300,000 passengers, and of these, four-fifths were in the London district. The mere figures, 300,000, convey very little impression to our minds; nor does it help us much to say that they equal the whole population of Sheffield, or of Brighton, Portsmouth, and Southampton all rolled into one. Perhaps we shall gain a better idea of what 300,000 people really means if we say that it is five times the number of troops that took two hours to march past Her Majesty at Aldershot in July, 1887, twelve times the number of the school children who were massed to meet her in Hyde Park. Nor could this vast army of pleasure-seekers be drafted hither or thither at the word of command; on the contrary, they all wanted to go the same way at the same time. They all poured out of London in the morning, and all had to be taken back again at night-fall. Before 4 P.M., 127,000 tickets had been collected at

* There are no special workmen's trains back at night; the cheap tickets are available by all trains after 4 P.M. on week-days, or noon on Saturdays.

suburban stations. Of these, about two-thirds had been collected at stations on the borders of Epping Forest, 37,653 of them at Chingford alone.

Epsom Downs on Derby Day is a desert compared to Chingford Plain on a Bank Holiday. The ingenious statisticians who calculate that "there are more Jews in London than in Jerusalem, more Scotchmen in Middlesex than in Midlothian," &c., should assuredly add a new clause to their formula, "and more cocoa-nuts in Chingford than in Otaheite;" but our concern is not with Aunt Sallies, but with railway passengers. The 37,000 passengers have to be taken home somehow in the course of about four or five hours. And there is one pair of lines available on which to take them. By dint of most careful arrangement the Company manages to work away ten trains in the hour, six for Liverpool Street, two for Fenchurch Street *viâ* Stratford, and two for Highgate and the North London. It is a very long and a very full train that can seat 700 passengers, so it must be confessed that these trains, which average about 1000 apiece, or say 15 per compartment, are distinctly well loaded.

But everybody expects it and nobody grumbles. Indeed, grumbling would be a work of supererogation, as, unless it were to employ balloons, the Company can do no more than it does. Hour after hour the exodus continues. The platform is a black and solid mass of human beings. A train comes in; in a single minute the train is packed as full as it can hold, and it moves off, leaving the platform bare. But five minutes afterwards, it is as solid again as ever. The present writer returned to town in the guard's van, and as special instructions had been given to keep it select, the occupants never numbered more than 25, babies included—but that of course was exceptional. The only thing the officials dread is a sudden downpour of rain about 8 or 9 o'clock, for then there is apt to be an ugly rush. But, as the writer saw it, the whole thing worked with the regularity of clockwork, and the good temper and docility of the vast mass was beyond all praise.

Most English companies can deal in a creditable manner with traffic when they get it. The Great Eastern is unique in the ingenuity with which it creates traffic. Witness the guide-books "meritorious and many," as Matthew Arnold would have termed them, that are issued in profusion, not, it may be presumed, without encouragement from the railway company, to every place of interest, either in the East of England, or easily accessible by the Harwich boats, for the modest sum of one penny or two pence. Other companies issue programmes of tourist arrangements every summer, the Great Eastern supplement theirs with a tourist's guide. Not a train leaves Liverpool Street at holiday times but the passengers have been supplied by ubiquitous little boys with a plentiful stock of Great Eastern literature, including one really most valuable document, a list of all the cottages, and farmhouses, and mansions all over the district, which are to let, or in which lodgings can be obtained. Nor is it only from London that the exodus is encouraged. Four days in every week a man may travel from Norwich to Cromer and back, 50 miles, by ordinary trains for one shilling and sixpence. If he will be content to wait till after mid-day he may go for one shilling. Last Whit Monday, the Great Eastern took one-fifth of the entire population of Norwich to the seaside. And Norwich is only a sample of what is done for the rest of the towns on the line.

In the endeavour to find new methods of tapping fresh springs of traffic, the Great Eastern, three summers back, sent two members of its staff over to the United States, granting them an extra long holiday and paying their expenses, in the hope that they would find some Yankee "notions," capable of transplantation to this exhausted soil. When the envoys returned, the only thing they could suggest was that a trial should be made of the American system of "expressing" baggage. A trial was accordingly made, advertisements were profusely issued, setting forth the readiness of the Company to collect and deliver passengers' luggage for a small fixed charge for each article. The result was that the first

year the gross receipts were £17 sterling; the second year they rose to a total of no less than £27.* And yet we are constantly assured that it is only the obstinate adherence of railway managers to obsolete methods that prevents English people from adopting the American system.

For the American system in America there is one obvious and sufficient recommendation—American people like it. But when we are urged to introduce that system into England, we may be permitted to stop and ask, *Cui bono?* The innovation might be advocated for any or all of three reasons—safety, economy, convenience. And under these different heads an Englishman can, I believe, unhesitatingly challenge the production of evidence to rebut the following answer. The percentage of baggage that goes astray in England without checks is not greater than in America with them. This may of course be due to the superior honesty of the English character, which successfully withstands temptation to which Americans would succumb, but that is beside the point. The fact exists and is all we have to do with. As for economy, an Englishman can take a cab at either end of his journey for less money than it costs in America to "express" a hat-box and a couple of portmanteaux. In point of convenience it is simply absurd to attempt a comparison. Will any American assert that he could alight at Euston at seven, and be ready for dinner a couple of miles off at eight, if his luggage had been handed over to an "express" company for delivery after his arrival?

We have dwelt so long upon the passenger traffic of the Company, that there is little space to speak of goods. But the same distinction may be observed in this department also. The North Western may carry bales of silk or tobacco, and

* The Great Eastern has been more successful than the North Western, which has also tried the system. I am informed that at Euston, which sometimes takes £4000 across the counter in the course of a single day, the receipts for a twelvemonth for "expressing" baggage could be covered by one £10 note.

truck-loads of tea. The Great Eastern remains a poor man's line, and is content to earn an honest penny *—sometimes, alas, it has to be content with a halfpenny—by the conveyance of bricks and stable manure, cabbages and turnips, and brewer's grains. Even in the fish traffic the same line of demarcation is sharply apparent. The North Western's chief customer is the lordly salmon. The mainstay of the Great Eastern is the humble bloater.

Like the third-class passenger, however, the bloater makes up in quantity his faults of quality. According to a return ordered by the House of Commons a few months back, the Great Eastern bring as much fish to London from ports on their own system in three weeks as the North Western in a twelvemonth. Between 60,000 and 80,000 tons of fish are landed every year at Yarmouth and Lowestoft, and five-sixths of this amount passes over the Great Eastern, nearly half of it to London. Of herrings, in particular, whose

* Two instances of the modest and meritorious thrift of the Company may be quoted. For 6*d.* the Great Eastern will deliver a large can of sea-water at any address in London, calling next day to fetch the empty can without extra charge. The other specimen shall be given in the words of a handbill that I picked up on a recent visit to Liverpool Street :—

GREAT EASTERN RAILWAY.

FOR SALE.

OLD
(RAILWAY)
CARRIAGE BODIES.

SUITABLE FOR
SHELTERS, SHEDS, TOOL AND STORE-HOUSES, COAL-YARD OFFICES, FOWL-HOUSES, &c.

DELIVERED FREE AT ANY G.E.R. STATION.

Price £5 each.

Application for form of tender and for order to view the Carriage Bodies at Stratford to be made to the undersigned.

Liverpool Street Terminus,
London, E.C., July, 1888.

J. HADFIELD,
Secretary.

numbers are calculated in lasts*—under an idea, apparently, that figures as well as words were intended to conceal thought—lest the actual magnitude of the totals should be too much for our weak minds, the average catch at these two ports is well over a million per diem. Of course, like all the other companies, the Great Eastern has been told recently that its rates are so high as to be practically prohibitory. The persons who make the charge have probably never reflected that, even supposing it to be true—which it is not—the fact would not necessarily imply any misconduct on the part of the Company. Herrings are undoubtedly cheap at Lowestoft and comparatively dear in London; but the same is the case with coal at Newcastle, and yet no one has hitherto suggested that the North Eastern and Great Northern shall be required on that account to carry it at a loss. Or again, water in Loch Katrine or Thirlmere costs absolutely nothing; but for all that the Corporations of Glasgow and Manchester are not expected to supply it gratis when it reaches those cities. In fact, one might meet the question raised by the Fish Traders' Association in the most direct manner, by asking: "Because herrings are food, and Londoners are hungry, is that any reason that railway shareholders should be called on to pay their neighbours' poor-rates?"

But the British public refuses to listen to discussions of abstract rights and wrongs, so the Great Eastern Company not long since provided a few concrete facts for their edification. A box of "prime" fish was bought at Yarmouth and another at Lowestoft on the same day. The average cost of the fish was 10·42*d.* per lb. Carriage to London and return of empty packages amounted to $\frac{1}{5}d.$ per lb., or rather less than 2 per cent. of the total outlay. Simultaneously an experiment was made with two boxes of cheap or "offal" fish. The cost in this case was only 0·9*d.* per lb., but carriage and return of empties now came down to 0·12*d.* per lb.—say the twenty-fifth part of a penny per fish—so that even here

* A last equals 1100 dozen = 13,200 fish.

less than one-eighth of the price in London was due to the railway rate. As herrings and bloaters are commonly sold in ones and twos, and the smallest English coin is a farthing, can anyone honestly profess to believe that, if the railway rate were reduced 50 per cent., or even if it were abolished altogether, the price of fish to the poor would be lowered one iota?

It is easy to prove that if the railway were required to carry fish for nothing, the first people to suffer would be the inhabitants of Lowestoft. For here, as in many other places, the railway does what the inhabitants either could not or would not do for themselves. It has enlarged and improved the harbour, and built a spacious and convenient fish market on the quay alongside. Having to build a pier, while it was about the task it has erected upon it a concert and reading room, which, if not equal to the splendid casinos of Continental watering-places, is yet better than most English seaside towns can boast of. And for the maintenance of all this, the Company is responsible. A responsibility by no means nominal at times, as last spring long-continued N.E. winds almost silted up the entrance, and caused an expenditure of several thousand pounds in dredging. But a company that carried fish gratis could scarcely be expected to maintain the fish market and the harbour out of the profits of the traffic.

Still, the Great Eastern has, on the whole, spite of the grumbling of fish-traders, good reason to be satisfied with its lot. It is forced to rely upon the million for its livelihood, and it has not been disappointed. How hard it works to develop its suburban passenger traffic we have seen already. Here is its reward as expressed in goods. For the three years 1883–4–5 the average tonnage dealt with at suburban stations was 375,000 tons. For 1886 the figures rose to 469,000, last year they were 572,000. In all England probably no place has grown so fast as Stratford, recently incorporated as the municipal and parliamentary borough of West Ham. A generation back its population

may have been 30,000; to-day it is something like 180,000. For the accommodation of the inhabitants of Stratford, the Company has opened a market for the sale of vegetable produce of all kinds. There are two rows of stalls down either side of a long covered avenue, opening out into convenient warehouses behind, these in their turn communicating directly with the sidings in the rear upon which the railway trucks arrive. A modest rent of £25 to £50 per annum covers all tolls and dues of every kind whatever, while for those to whom even this charge is prohibitory there is ample open ground available in which they can pitch their stalls and display the contents of their half a dozen baskets for the payment of a few pence per diem.

And if at the one end of its system the Company endeavours to encourage the small trader, at the other it is equally careful of the interests of the small producer. It has recently reduced its rates for vegetables in small quantities, with the avowed intention of encouraging allotment gardening, almost to the level of those for produce sent in bulk. Eightpence for a hamper of vegetables weighing 1 cwt. from Norwich to London, is a charge that even Prof. Hunter, M.P., could hardly stigmatise as excessive. That the establishment of Stratford Market has met a real need is sufficiently shown by the fact that the tonnage passing through it has risen from 5000 to 33,000 within eight years.*

Down in the fens of Cambridgeshire, near Wisbech, the Great Eastern has administered to agriculture a stimulus of a different and more direct kind. It has constructed, at the cost of about £4000 a mile, a tramway or light railroad some six miles in length. For two-thirds of the distance it runs along the high road, and the engines (which are limited

* The Great Eastern does not profess to be animated by any other motive than enlightened self-interest in reducing its rates for roots and vegetables to the lowest possible point. "If a farmer grows turnips and potatoes," say the authorities, "he has a very large weight of produce per acre to send over our line. If he grows wheat he will have but four or five quarters. It is better for us to get a small profit on twenty tons than a much larger profit on a single ton."

by Act of Parliament to a speed of ten miles an hour) and the cars are of the ordinary tramway pattern. But, on the other hand, the line is laid on the ordinary gauge, so that the railway goods trucks go through without the expense of transhipment. To say nothing of the advantage to passengers, who get six trains each way daily, this little line deals with over 500 tons of goods a week, 95 per cent. of the whole being through traffic coming from or going on to the railway beyond, so it can hardly be but that it has met a real want in the district. We shall probably hear a good deal more of light railways of a similar kind in England in the immediate future. That from Wolverton to Stony Stratford, in connection with the North Western, which has been more recently opened, is already pronounced a success, and it is difficult to think that a system, which in Holland is almost as important as railways themselves, can have no proper sphere of utility in England. For my own part, I have often wondered why no railway in this country experiments on its small agricultural branches with the light class of rolling-stock, that earns for English shareholders, under English management, a handsome dividend from agricultural traffic no farther off than in the flat plains of Western Flanders.

Encouraged by their success at Stratford, the Company resolved in 1882 to try a similar experiment in London itself. They converted the arches beneath their Bishopsgate goods station, which stands on the site that was disgraced for years by the tumble-down sheds of the Shoreditch Terminus, into a series of market stalls—for fish on the one side, and vegetables on the other, with railway communication down the centre. The success was rapid and unmistakable. Within eighteen months the tonnage of perishable commodities brought into Bishopsgate actually doubled. Unfortunately, the lessees of the adjacent Spitalfields Market took alarm, invoked the aid of an ancient charter, and after long litigation obtained a decision of the House of Lords which closed the Great Eastern Market. The rights of property are no doubt sacred,

but one need not be an extreme Radical to hold that the inhabitants of London have also some rights, even though unsecured by charter, and that a charter that was granted in a mediæval village would be the better of modification before it is applied strictly to a city of five million people. It may be, too, that a railway company is not a proper market authority, but when municipal authorities are either supine or non-existent, surely even a railway company must be better than nothing. The House of Lords is of course bound to decide according to law, but the present writer cannot but think that if their lordships, before pronouncing judgment, had spent a morning or two, say from 6 to 8 A.M., at Billingsgate, they would have tried hard to find reasons for altering their decision, and failing that, would have determined to abrogate in their legislative capacity at the earliest possible moment the judgment that they had found themselves constrained to pronounce judicially.

Since the middle of 1884 the market has been closed, and the Company has had to make what use they can of the abandoned arches. It gives one some idea of the size of a London goods station to find that a single arch, in the occupation of a firm of wine merchants, provides storage for 150,000 dozen of wine. An adjoining arch is used, not for wine indeed but for bottles. How many bottles this arch will hold, it would need a calculating machine to reckon, but one fine day last August there were over 1000 different patterns in stock, and a single customer was said to take 3000 gross of celery-salt bottles of a special make in the course of a year. As for jam-bottles—the jam-pot will soon be found only in museums—the lessees of the arch were only supplying Messrs. —— with 150 gross per diem. But then the fruit was very backward last summer, and Messrs. —— had similar contracts with three other manufacturers. The bottles arrive, sometimes laid in straw in the trucks, more frequently simply packed in sacks, the latter method being adopted to ensure that the railway porters shall handle them tenderly. One other special piece of traffic into Bishopsgate

must just be mentioned. The district round Maldon in Essex is famous for its green peas, and at the end of July last the Great Eastern were running three trains a day loaded with green peas only. The wet weather had made the crop heavier than usual, and one single day, August 4th, saw the biggest consignment on record, amounting to 578 tons, all of which was safely delivered by 7 o'clock the following morning. To show the extraordinary character of the summer of 1888, it may be added that the entire month of August, 1887, only accounted for 16 tons, while August, 1884, and August, 1885, had only a total of 10 tons between them.*

Allusion has already been made to the convenience of the through connection from all parts of England to Harwich. Here are one or two disjointed notes in reference to the Continental services. One lesson I carried away from a visit to Harwich, a short time since—and my readers, if they are wise, will lay it to heart also—never to send personal luggage except with passengers. The curiosity of Custom House officials is insatiable, while their experience as packers is less than rudimentary. There has been a good deal of talk lately because a few hundred horses have been imported into this country from Canada. Not many people, perhaps, are aware that the export of horses from the United Kingdom, mostly Irish-bred, is so large and so constant, that at Harwich it is worth while specially to provide stabling which can take in 80 horses. The other day 120 went abroad in a single batch.

A few years back, the Great Eastern, with considerable hesitation and doubt as to what might be the effect on

* [Mention must just be made of the extraordinarily low rates for small consignments of agricultural and dairy produce introduced by the Great Eastern a year or two back, and since copied by several other companies. English railway rates are usually supposed to be higher than those of other countries ; but it is safe to say that a charge of fourpence for the carriage by train for 100 miles of a package weighing 20 lbs. and its delivery by cart at the customer's door cannot be equalled or approached for moderation in any other country. 1899.]

their passenger traffic, determined that for the future their steamers should be screw and not paddle boats. They have now found by experience that passengers prefer the new vessels, which owing to the tortuous passage up the Maas and the Scheldt are all fitted with twin screws, while the economy both of coal and cargo space is of course unmistakable. One of the best of the Channel lines hands over the refreshment department to a local publican, who caters after his kind; on another the writer well remembers being presented at 11.30 A.M. with a steaming joint of boiled beef and a much-hacked loaf of stale bread as an appetising substitute for a French *déjeuner*. On the Harwich boats everything is provided by the Company itself, and the food is not only cooked, but served in a manner that could not offend the most fastidious appetite. And this, as the Harwich route secures a period of a couple of hours of calm water in the river—the Maas or the Scheldt as the case may be—available in the morning for breakfast, and in the evening for dinner, is not a matter of unimportance.

We must not conclude without noticing the Stratford Works. By the side of Crewe, Swindon, or Derby, they are of course small, but everything about them is eminently business-like. Close at hand is a building in which the Company executes almost the whole of its own printing—the only line except the Chatham and Dover that does so. A great railway company gets through a good deal of stationery in the course of the twelvemonth. The Great Eastern has a thousand different printed forms—invoices, delivery notes waybills, and so forth—constantly in use. Then there are the working time-books for the use of the staff, and the penny time-books for issue to the public. Of these latter, 60,000 copies were printed for a single month last summer. The weekly notices of special excursions sometimes run to a small folio of sixty pages, while last Easter two million and a half of handbills were printed and distributed. One more item must be mentioned, the list of shareholders, a closely

printed volume of 280 pages, with eighty names to a page, which the wisdom of the Legislature requires to be published and sold at a maximum charge of 5*s.*, for the special use and behoof of the "bucket shops" which tout for subscribers to imaginary gold mines. In the printing works the Company keeps about 110 persons constantly employed, and is understood to save a good deal of money by so doing.

For indeed the Great Eastern has every reason to take care of the pence. Hitherto it has had scant opportunity for testing the truth of the other half of the proverb. But while on the one hand it never spends money if it can help it, on the other hand it never palters over a necessary outlay. Its entire rolling-stock, for example, is and has been for years past fitted with the Westinghouse automatic brake. The hose-pipes having given some trouble by bursting, recently a rule has been laid down that every pipe is to be withdrawn and replaced after two years service. In fact the Great Eastern rolling-stock is nowadays distinctly creditable. I had the opportunity of comparing the third-class carriages built in 1864 with those that are being turned out at Stratford to-day. The old pattern gave each passenger 23 cubic feet of space, the modern one gives him 31. To do so, however, implies for the Company, in addition to the expenditure on blinds and cushions—luxuries of which the third-class passenger of the last generation would never have dreamed—the haulage of an additional 50 per cent. of dead weight per passenger. Again, leaving it to richer companies to experiment with different methods of application of the electric light, the Great Eastern is steadily fitting not only its suburban but its main-line trains with gas. It may be questioned, however, whether this will not prove in the end an economy. One little item of the cost of oil-lighting that will now be avoided is the replacement of 2000 broken lamp-glasses every month.

As already mentioned, it was in the Stratford shops that the first recorded compound locomotive was born. The Nicholson-Samuel engines have vanished and left not a

wrack behind, and the later history of the Worsdell compounds, also originally introduced at Stratford, is to be traced rather on the North than on the Great Eastern.* But Stratford is a good deal occupied just now with experiments that may some day prove of at least equal importance. In the Company's gasworks there is produced a considerable quantity both of coal-tar and of shale-oil refuse, and as nobody will buy tar nowadays, these products have to be got rid of somehow. It was determined some time back to try to burn them. First of all the liquid fuel was used to heat the gas retorts themselves; then several boilers and furnaces in the shops were fitted with the necessary apparatus; finally two tank locomotives were taken in hand, and they have been for some eighteen months burning a mixture of tar and creosote oil, and taking their share in the ordinary work of the line.

Externally, except perhaps in the fact that they never need make a black smoke, there is nothing to distinguish these two engines from their fellows, but a portion of the coal-bunker is occupied by a tank containing about 200 gallons of tar. Underneath the footplate a small pipe passes into the fire-box, where it ends in a nozzle surrounded by an outer ring. The fire is lighted in the ordinary way, but only a few pounds of coal are used, spread as thinly as possible over the bars. Sometimes, for the sake of economy, the coal is mixed with lumps of chalk, which act like the balls of fire-clay in a domestic grate. When the fire has burnt up, the tar is turned on, and a steam injector forces it into the fire-box in the form of spray. Then a second supply of steam and air through the outer ring meets and dilutes the spray still further, so as to ensure perfect combustion. That

* There are still among the Great Eastern engines a few that were built in France at Schneider's great Creuzot works about twenty years since. It is said that the Emperor specially interested himself to enable the French firm to compete on advantageous terms for an English contract. I have already mentioned the American engines that worked for many years the Lickey incline. It would be interesting to know if there has ever been another instance of our importing locomotives [until this year, 1899].

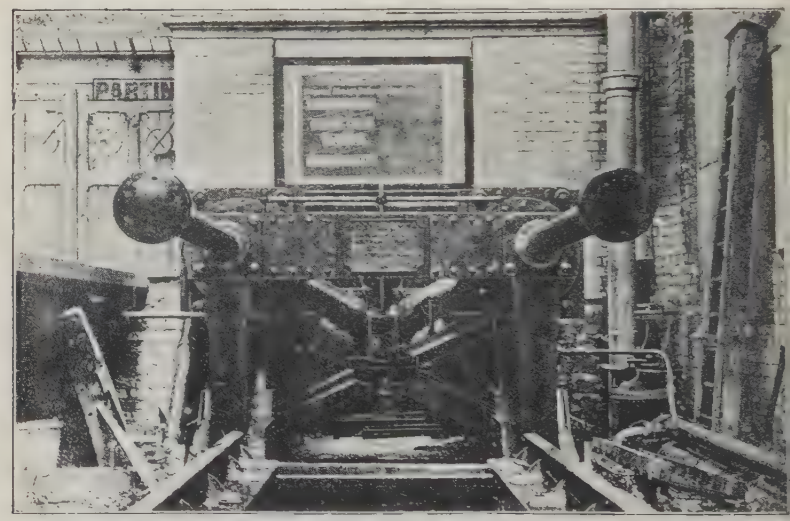
there is no difficulty in obtaining sufficient heat may be judged from the fact that the boiler pressure has been raised from 50 to 140 lbs. in nine minutes. It is calculated that the engine burns about a gallon (say 11 lbs.) of tar per mile, and that therefore 1 lb. of liquid is roughly equal to 2 lbs. of solid fuel. Taking the cost of the former at 1*d.* per gallon, it would appear as if the financial result was much the same as when burning coal, but practically in this case the Company gets its tar and its shale-oil refuse for nothing. Moreover, if the system were generally adopted, there would be an obvious economy in the fact that the oil can be stored anywhere—underground if necessary—and supplied to the locomotives simply by turning on a tap.

One other point may be noticed in conclusion as to the Stratford locomotives. The reaction in favour of single-wheeled engines for fast traffic with moderately light trains, that has been so conspicuous a feature of the locomotive history of the last few years, has not been unfelt on the Great Eastern, and single engines are at present being built to work the "joint line" trains between London and Doncaster. These trains are never very heavy, always run fast—about 42 miles an hour, including stoppages—and travel over a line for the most part dead level. Before the change was made, the two systems were compared in the following manner. An ordinary coupled engine was taken, and its coupling-rods removed, no other change being made. It was found to work the trains, not only with more ease than before, but with a perceptible diminution in the amount of coal.

We have now passed in review all the great companies that have termini in London. We have dealt with other railways as praiseworthy as the Great Eastern, we have certainly dealt with none that are more so. But lest it should be thought that this latter has been described in terms of extravagant panegyric, let it be remembered that other companies have not the blackness of their

misdeeds of yesterday as a foil to set off their brightness of to-day.*

* "You have praised the Great Eastern with a vengeance," said a resident on the line to the present writer soon after this chapter was published in its original form. "Do they not deserve it?" was my reply. "Well, yes, no doubt they do; but you needn't say too much about it: there's a good deal of pretty rural scenery still left in my neighbourhood, and we don't want it spoiled by being built over." [Ten years ago the public were only half conscious of the rapid progress that was being made by the Great Eastern. To-day not only the public, but the shareholders, whose stock has practically doubled in value in the decade, are fully awake to it. 1899.]



"DEAD END"—NEW STYLE.

SUPPLEMENTARY CHAPTER.

In this chapter an attempt is made to summarise the progress made on English railways since 1889. Subjects which can be conveniently dealt with as a whole have been so treated; miscellaneous improvements have already been noted under the head of the company to which they belong.

In the matter of speed the North Western can claim credit for one sweeping improvement. This great Company has acted on its traditional policy. Having at length been convinced—a good many years, it must be confessed, after the outside public—that its Holyhead service was unworthy of the North Western, it has simply swept the whole thing away and given a new service so admirable that criticism is silenced. On the mail trains express fares have been abolished, third-class tickets are issued by all of them, and the average timing is cut down by over half an hour. As for the four North Wall trains, of which ten years ago only one reached the minimum express speed of 40 miles an hour, they average 4 minutes faster than the mails, the best of them being timed at over 50 miles an hour, and running the whole 264¾ miles with only one intermediate stop.

Of the Midland, on the other hand, the less said the better. Leicester to London, 99¼ miles, in 115 minutes, which was then the timing of the up Glasgow day express, seemed phenomenal over the Midland road ten years ago, and 114 minutes, which is the present timing, is first-rate even nowadays. But ten years ago, before Derby had taught us the use of the word "decelerate," we did not expect improvements of the best Midland express to advance at the rate of 6 seconds per annum. Even the Great Northern record is distinctly disappointing. The Manchester service has been knocked to pieces by diversion through Nottingham and extensions in Manchester to the Central Station.

The other services are as good as ever: they are not better. The best Leeds expresses are practically unaltered, while the fastest train to York to-day is actually 5 minutes slower than the timing of August, 1888, as given in the official circular on p. 223, 9 minutes slower than the advertised timing of August, 1896, and no less than 49 minutes slower than the actual best performance of the summer of 1895.

For all that, it is only fair to recognise that the Scotch services, both East Coast and West Coast, have improved greatly in the last ten years, though at the same time it should be noted that the non-London companies—the North Eastern, the North British, and, before all, the Caledonian—are entitled to a full share of the credit therefor. Ten years ago Glasgow was distant 9 hours from London, Edinburgh 8½: to-day they are distant 8 hours and 7¾ hours respectively. To Perth the time has come down from 10 hours 15 minutes to under 9 hours; to Aberdeen from 12 hours 50 minutes to 11 hours 5 minutes. What the connections might be, however, if the companies had continued to aim at the high-water mark of their spring-tide attainment is shown by the fact that in August, 1895, Edinburgh was reached on the 21st in 6 hours 19

minutes from King's Cross, Perth on the 22nd in 7 hours 18 minutes from Euston, and Aberdeen in 8 hours 40 minutes on the 21st from King's Cross, and in 8 hours 32 minutes on the 22nd from Euston.

With one exception, to be noticed directly, the improvements in speed of the remaining companies call for scant notice. The Lancashire and Yorkshire Company has raised its standard all round; but then Lancashire and Yorkshire folk take improvements for granted, and, besides, the performances of 1889 are not recorded in the body of this book so as to be available for comparison with those of 1899. The Brighton Company has awakened from its slumbers, and, as an earnest of improvements to follow, has put on a special Sunday express, covering the 51 miles between Brighton and Victoria in the level hour. The South Western has knocked half an hour off the time of its best Exeter express, which now runs over the very heavy gradients to the west of Sherborne at the highly creditable speed of 49 miles an hour, and has this summer [1899] put on four new and quite first-class expresses between London and Weymouth. These trains run without a stop between Waterloo and Bournemouth (107 miles) in 125 minutes. Below Bournemouth they are allowed about an hour for 35½ miles with three stops, including attachment or detachment of the Swanage coaches at Wareham and change of engines at Dorchester. The Great Eastern, though in the matter of speed it has not yet attained to brilliance, has still persisted steadily in its course of improvement. The Harwich boat expresses are 15 minutes quicker than they were in 1889; while the best Cromer express, accelerated by 35 minutes since 1888, now runs during the summer months the 131 miles from Liverpool Street to North Walsham without a stop in 140 minutes, a quite first-class performance.

But the company taking the first place without question for improvements during the decade is the Great Western,

which at the close of the century appears determined to reclaim the position that it held fifty years before as *the* express line. It would hardly be an exaggeration to say that in ten years the Great Western has made as many improvements as all the other English companies put together; that it has doubled its mileage of express trains, and increased their average speed by from 5 to 10 miles an hour. To those who know how the atmosphere of the whole system has changed in the last few years, it would really seem as though the final abolition of the broad-gauge in the spring of 1892 had let in a blast of keen north-country air not only into the offices at Paddington, but into all the sleepy hollows of Wilts and Somerset, and even into the lotus-eating valleys of Devon and Cornwall. Ten years ago Mr. Foxwell, in *Express Trains, English and Foreign*, declared that "the great Brunel might turn in his grave" at Great Western results, "so poor in comparison with what the northern lines present." But if we renew the comparison to-day we find that Oxford (63½ miles) is 2 minutes nearer Paddington than Northampton (65¾ miles) is to Euston; that Bath (107 miles) is reached at the same time from Paddington as Grantham (105¼ miles) from King's Cross. Bristol to Exeter, 75½ miles, in 88 minutes is faster by 2 minutes than any timing between Willesden and Rugby (77 miles), 2 minutes slower than the best Great Northern time between King's Cross and Peterborough (76¼ miles), and 5 minutes slower than the best Midland express between St. Pancras and Kettering (72¼ miles). The Great Western reaches Bristol (118½ miles) in 2¼ hours, 5 minutes quicker than the best North Western train to Birmingham, which is only 113 miles from Euston. It might be added that, since July of this year, the best Great Western express to Birmingham itself is only 7 minutes slower than the best North Western, though the Great Western route is 16½ miles longer. Here is in tabular form a comparison of the best expresses for practically similar

distances out of London according to *Bradshaw* for February, 1899:—

Company.	Between	Fastest time.	Train.	Distance.	Speed. m. p. h.
		h. m.			
G W. . .	Paddington and Exeter	3 53*	10.35 a.m. down 3.7 p.m. up	194	49·9
L. & N.W. .	Euston and Manchester	4 10	8.30 a.m. up	188¾	46·1
L. & N.W. .	Euston and Liverpool	4 15†	3 trains each way	193½	45·5
G.N. . .	King's Cross and Leeds	3 49	9.45 a.m. down	185½	48·6
G.N. . .	King's Cross and York	3 35	8.15 p.m. } down 11.20 p.m. }	188	52·4
G.N. & G.C. .	King's Cross and Manchester	4 15	2 p.m., both ways	203	47 3
Midland. .	St. Pancras and Manchester	4 20	4 p.m. down 12 noon } up 5.35 p.m. }	191	44·07
Midland. .	St. Pancras and Leeds	4 5 4 15	3.15 p.m. up 10 p.m. down	198‡ 204§	48·4 48

Though the improvement in speed on our English lines, taken altogether, is not very great, and, as we shall see directly, has by no means kept pace with the improvement outside England, it is fair to remember that a high average speed is much more difficult to attain and maintain than it was ten years ago. Not only are the trains themselves very much heavier, but they run on lines very much more congested and have to do their work at stations overcrowded with passengers, luggage, and bicycles. Even to maintain the speeds of ten years ago, and much more to increase them, it has been necessary to cut out stops with an

* During the summer months a relief train, starting at 10.30 and running through without a stop, does this run in 3 hours 43 minutes, or 10 minutes quicker, giving a speed equal to 52·19 miles per hour.

† Two days a week the American boat specials are timed from Euston through the Waterloo Tunnel (see p. 125) to the Liverpool landing stage, which is not only 2½ miles further, but also much less convenient of access for express trains, than Lime Street Station, in 4 hours, one more proof how much the North Western always keeps "in hand." Between Euston and Edgehill the time allowed is 220 minutes for 192 miles = 52·3 miles per hour.

‡ *Vid* Leicester. § *Vid* Nottingham.

unsparing hand. Swindon has become almost a roadside station, and no less than eleven down expresses run every day through Willesden Junction without stopping. On page 244 is given a list of all the stretches of line of a length of 100 miles and upward run over in the summer of 1888 without a stop. They only numbered seven, and the number of runs over them was only a dozen a day. Ten years later the number of runs had increased to about seventy, run over some twenty different stretches of line. And the two longest runs of 1888—Newcastle to Edinburgh, 124½ miles, and St. Pancras to Nottingham, 124 miles—had sunk to quite a low position on the list. The Great Western had not in 1888 entered the 100-mile class at all; to-day we have on this line alone the following: London to Exeter, 194 miles; London to Newport, 143 miles; London to Birmingham, 129 miles; London to Bristol, 118 miles; and London to Bath, 107 miles. On the North Western, which only first entered the class in the autumn of 1888 with a run from Wigan to Carlisle, there are now Euston to Crewe, 158 miles; Crewe to Willesden, 151½ miles; Crewe to Carlisle, 141 miles; Euston to Stafford, 133½ miles; Stafford to Holyhead, 131¼ miles; Willesden to Stafford, 128 miles; and Wigan to Carlisle, 105¼ miles. As for the Great Northern, it runs now about 16 times a day between Grantham and King's Cross (105¼ miles) or Finsbury Park (102¾ miles) without a stop, and it has added the following new breaks: King's Cross to Newark, 120 miles; Peterborough to York, 112 miles; and Grantham to Malton, 106¾ miles. Two other companies also find a place in the list: the Great Eastern, with runs between Liverpool Street and North Walsham, 131 miles, and Liverpool Street and Yarmouth, 121¾ miles; and the South Western, with six runs a day ranging in length from 104 to 107 miles, between Bournemouth or Christchurch and London.* The many fine

* Some of these are summer runs only.

100-mile runs on the Caledonian, and the creditable performances in the same direction of the Great Southern and Western of Ireland, fall outside the scope of this book.

This cutting out of stops has necessitated arrangements for feeding both engines and passengers *en route*. The Great Western, the North Eastern, and the Great Eastern have all adopted "pick-up troughs" (see p. 81). Dining-cars have become almost a matter of course, and they are now very generally available for third-class as well as first-class passengers. The North Western has, as usual, carried a policy which it did not inaugurate further than any of its rivals, and hardly an express leaves or reaches Euston without breakfast or luncheon or dining cars attached. The Great Eastern has hit on a novelty with a supper train at midnight on Saturdays to its rising watering-place of Clacton. But the Great Western has hitherto marred its admirable "Cornishman" by running a train nearly four hours on end without so much as a bun or a bottle of ginger-beer on board. This summer (1899) it has for the first time introduced a luncheon-car, but first-class only, which would seem to offer a very Barmecide feast for nine-tenths of the passengers.

The addition to the through expresses of dining-cars, of corridors to enable the dining-cars to be reached, and of lavatories, now almost universal for all classes, has naturally added very considerably to their weight. The growth of sleeping-cars and their more ample space—the Great Western and the East Coast and West Coast "sleepers" now give each occupant a compartment to himself—has tended still further in the same direction. What the average weight of an English express was ten years ago there are no statistics to show. But at that time I estimated it (see p. 231) as under rather than over 150 tons. From three admirable annual summaries of our locomotive progress during the years 1896–8, contributed by Mr. Rous-Marten to the *Bulletin of the International*

Railway Congress,* I find that he personally observed the working of 101 different expresses during those three years, and that their average weight was 216 tons, exclusive of engine and tender. It will therefore not be far wrong to say that locomotives are nowadays expected to haul, at booked speeds which have certainly not fallen, 50 per cent. more weight than was on the average put upon them ten years ago. This means of course a greatly increased demand for power. Our engines, thanks largely to the excellence of our coal, are still very small for the work they have to do when judged by Continental comparisons, and are mere pigmies by the side of the giants of the United States. But their size and power have greatly increased within the decade. Steam pressure has gone up on the average, say, from 140 lbs. to 175 lbs. Heating surface has reached, in the case of the new Lancashire and Yorkshire engines, as much as 2000 feet; 1500 feet was regarded as very large ten years ago. Cylinder diameter is normally now about 19 inches: it was 18. And so on all the way through.

I must not attempt to write a locomotive history. One point is, however, of so much interest that it must not pass unnoticed. During the past ten years in France, in Prussia, in Austria, and in America compound engines for express work have become so common that their employment may almost be said to be normal. Simultaneously in Great Britain the compounds on the Great Eastern and the bulk of those on the North Eastern have been rebuilt as non-compounds. Practically speaking, no new compounds have been introduced even as an experiment on any line except the North Western. On this latter system there are now

* *Bulletin of the International Railway Congress* (January, 1897; February, 1898; February, 1899), published by P. S. King and Son, Westminster. In these three articles those who wish for exhaustive and accurate information will find full particulars of the dimensions, weights, performances, &c., of all the important types of modern express engines in this country.

LATEST TYPE OF ENGLISH EXPRESS ENGINE
(Lancashire and Yorkshire Railway)

running about 100 compound express engines, and Mr. Webb has lately introduced among them a new four-cylinder type. Here is one more "insularity" for which, not being a mechanical engineer, I must not attempt to account. The cause is not to be found in deficiency of speed. This allegation is sufficiently disproved not only by the records of our own North Western, but by the performances of Mr. von Glehn's compounds in France and the Vauclain compounds in America, at booked speeds to which we have, alas! no parallels here. Nor can the reason be found in the cheapness of our coal, for coal is vastly cheaper in the States than in England.* The question deserves, I think, further investigation by the comparative method than it has as yet received.

One prominent feature of the last decade has been the very great increase of what may be called, in the convenient American phrase, four-track mileage. All over England the process has been going on. Even the poverty-stricken Chatham and Dover has managed to get four lines as far out as Bickley. The South Eastern is widening as far as Orpington, the Brighton to Redhill, and the South Western to Basingstoke. The Great Northern relief lines into London seem to fill up almost before they are fairly opened. The Great Western has already got four lines to Didcot, is extending them to Swindon, and is constructing a new direct route from London, through Wycombe, to the North as well. The Midland has spent millions on widenings from Bedford to London, and from Trent to Leeds; last year it obtained powers to widen also between Kettering and Trent. The North Western has long had four lines almost the whole way to Crewe, but it is now engaged in quadrupling on the Chester and Holyhead and the Lancaster and Carlisle. And yet such is the prosperity of the country at the present time that there will doubtless be traffic to

* The average price per ton paid last year (1898) by the Chesapeake and Ohio Railroad was fifty-four cents = 2*s.* 3*d.*

LATEST TYPE OF AMERICAN EXPRESS ENGINE
(Philadelphia and Reading Railroad).

spare for the new Great Central route, even if at the outset it be insufficient to pay adequate interest on the vast sum of £12,000,000 which the Great Central has spent on its hundred miles of new line and the establishment of itself in possession of its immense terminus in Marylebone.

The travelling public has gained greatly by the constant concessions in fares which have gone on from 1888 to 1898. The first-class fares have everywhere, with the single exception of the South Eastern-Chatham boat expresses—an exception which, it is said, is to cease almost immediately—been reduced to 2*d.* per mile, the point at which the great northern companies fixed them a long while back. And express fares have, with the one exception above noted, finally disappeared. The reduction is in many cases quite considerable. To Penzance, for example, the first-class fare has fallen from 63*s.* 6*d.* to 50*s.* 6*d.*, to Brighton from 12*s.* 6*d.* to 8*s.* 6*d.* In the case of second-class traffic the change has been even greater. North and east of a line which may roughly be drawn from the mouth of the Thames to London, and thence through Leicester, Derby, Sheffield, and Leeds to Carlisle, second-class carriages have, it may be said, disappeared entirely. South and west of this line they still continue, but the fare, which ten years ago often ran up to 2*d.* a mile, is never now more than 1¼*d.* To quote again the same two instances, the Penzance second-class fare was 44*s.* 6*d.*; it is now 31*s.* 6*d.*; the Brighton fare was 8*s.* express, 6*s.* 6*d.* ordinary; it is now 5*s.*

It would be very interesting, if any statistics existed on which a reliable judgment could be based, to estimate the effect of these reductions. But, in the lamentable absence of statistical information, one can only guess. It would seem, however, as though the reductions in first-class fares had been a sheer gift to first-class passengers, and had failed to attract any new customers for first-class carriages. The second-class history has been different. The number of second-class passengers has greatly increased, and the companies' receipts from second-class tickets have increased also.

LATEST TYPE OF AMERICAN FREIGHT ENGINE
(Lehigh Valley Railroad).

At first there can be no doubt a considerable number of passengers were attracted upwards from the third class, each of them thinking that he (or more especially she) would get more space and better company for only a slight additional fare. The result was that the second-class compartments, of which there were probably only four or five on a train, were often even fuller than the third. So the companies, who had hoped to fill up empty carriages at no extra cost, were forced hurriedly to build new second-class stock, and so to incur new expense. Simultaneously the new second-class passengers began to wonder whether, if they got no extra space, it was really worth their while to pay even a farthing a mile extra, and so they gravitated back to the third class. But this was not all. When fares for the three classes were at the respective rates of, say, $2\frac{1}{4}d.$, $1\frac{3}{4}d.$, and $1d.$, passengers who objected to travel third might naturally think that a first-class ticket, which combined comfort and dignity for $2\frac{1}{4}d.$, was better value for the money than a second-class at $1\frac{3}{4}d.$ With fares based on the revised scale of $2d.$, $1\frac{1}{4}d.$, and $1d.$, the conditions are a good deal altered, and there is accordingly *a priori* reason for believing, what a certain amount of available evidence tends to confirm, that at present the second-class is recruiting its passengers largely from those who had been accustomed to travel first. But, as I have said, in the absence of precise statistics of passenger traffic, which in any other civilised country would be available both to justify a reform and to estimate its after-effects, none of us can do more than guess on this matter.

Third-class traffic, though notoriously it is increasing at the fastest rate, has enjoyed no concessions in the normal rates. Indeed, two or three years back, the South Eastern and Chatham companies put up to a penny a mile a large number of fares that had previously been below, in some cases a good deal below, that figure. But for all that the third-class passenger has gained vastly. First in accommodation. No company now builds carriages for his use in

LONDON ROAD (MANCHESTER) STATION
(Great Central Railway)

long-distance traffic without lavatories. He has conquered admission into dining-cars; his admission to the "sleeper" also can hardly be much longer delayed. It is within the mark to say that the third-class "diners" running from London to Leeds, Manchester, and Scotland give more luxurious accommodation than the average first-class carriage of a dozen years ago. But this is not all. Year by year the gap widens between the normal and the average third-class fare. Nothing has been more marked in recent railway history than the growth of the cheap fares. Workmen's trains at a farthing a mile, day or half-day excursions at somewhat similar rates, excursions for a week, ten days, or a fortnight, at perhaps a halfpenny, week-end returns at single fares for the double journey, third-class season tickets (except in the London district)—all these are made use of by such enormous numbers of passengers that the normal penny-a-mile rate is greatly diluted. English railway fares are often complained of as excessive on the strength of a comparison made between the normal tariff rates in England and the average of all fares actually charged in Continental countries. Now in France, where statistics *do* exist, we know that the average fare paid is only about three-fifths of the normal tariff rate. And in France the opportunities of travelling at reduced rates are very much less than here. I am persuaded that the average fare paid here cannot be more than three-farthings per mile, and is probably a good deal less, a figure which, if not exactly cheap as compared with Continental fares, is yet, when allowance is made for the lower value of money in England, for the vastly superior accommodation given, for the amount of free baggage allowed, etc., one of which the English companies have no reason to be ashamed.

On p. 280 will be found a comparison of certain English services with certain fairly comparable foreign ones as they were ten years ago. Below is the same comparison brought up to date:—

Route.	Distance in miles.	Time of fastest train.	Speed in miles per hour.	Fares.			Fares per mile in pence.		
				1st.	2nd.	3rd.	1st.	2nd.	3rd.
		hrs. min.							
London and Milford	280¼	6 40	42	43/6	27/2	21/8½	1·89	1·16	·90
London and Penzance	326½	8 32	38·2	50/6	31/6	25/3	1·89	1·16	·90
Paris and Brest .	381¼	12 55	30·2	52/10	36/-	[23/5]	1·66	1·13	·79
Paris and Marseilles	540	12 59	40·1	77/4	[52/2]	[34/-]	1·72	1·16	·75
Do. (*train de luxe*)	,,	11 57	45	127/8	—	—	2·84	—	—
Berlin and Kiel (*vid* Hamburg) .	249½	6 4	39	38/2	28/11	[18/10]	1·84	1·39	·90
Berlin and Dantzic	286	7 0	40·8	43/10	33/-	22/9	1·84	1·39	·94
Vienna and Trieste	372½	12 45	29 1	45/6	34/1	22/9	1·46	1·10	72
Do. (*train de luxe*)	,,	11 57	31·1	60,6	—	—	1·65	—	—

N.B.—The fastest train is in all cases taken, whether up or down.
Fares enclosed in brackets do not admit to the best train

This table is, I think, not without interest. In the matter of fares it shows for England a considerable reduction in first-class, a great drop in second-class, and a small reduction in third-class. France has reduced—mainly, however, at the expense of the general taxpayer—its first-class fares about 10 per cent., its second about 15 per cent., and its third-class nearly 25 per cent. In Prussia the fares have actually gone up, owing to the fact that the principal expresses, the so-called "concertina trains," are now composed entirely of vestibuled corridor coaches, for which an extra charge is made. In Austria the introduction of a zone tariff has, as will be seen, been accompanied by sweeping reductions of long-distance rates for all classes. As for speed, the smallest improvement is, naturally enough, shown between London and Penzance, a road of which the first 200 miles have always been run at high speed, while the last 100 are in a country where high speed is impossible.

LATEST TYPE OF WAGON-LIT SALOON

But it will be noticed that the improvement between London and Milford, considerable as it is, is on the whole less than that made not only by the Paris and Lyons Company and the Prussian State, but actually by the Austrian Südbahn, a company whose traditional motto is said by the Viennese to be "*Immer langsam voran.*"

The instances are, I think, typical enough, and show, what is indeed the truth, that in the matter of speed we are certainly not increasing the lead we have long held. But the trains in the above table were selected originally as typical not of the best, but of average, express speed. When it is a question of comparing the absolutely best expresses in different countries, our own unfortunately comes even worse out of it. Take, for instance, the comparison instituted on p. 233 between the English and French performances on the through mail service between Paris and Leeds. The English mail runs to-day, exactly as it did ten years ago, from London to Leeds and back in 8 hours; but the French trains, which continue the service, took over the same distance 10 hours 50 minutes in 1889, while they take to-day 8 hours 40 minutes. Moreover, 4 hours each way is practically the shortest time between Leeds and London; only three trains take less; the fastest takes 3 hours 49 minutes. Between Paris and Calais, with a course certainly not easier and with trains unquestionably heavier, there are the following timings: 3 hours 54 minutes, 3 hours 50 minutes, 3 hours 45 minutes, and last, not least, 3 hours 15 minutes. This latter train, the continuation northward of the Paris and Lyons Company's *luxe* on days when the latter arrives too late to catch the ordinary 11.50 A.M. out of Paris, is unquestionably the fastest express in the world outside America. From Paris to Amiens, 81½ miles, it is allowed 81 minutes; it covers the 103½ miles forward to Calais pier in another 109 minutes. Euston to Manchester is 2 miles shorter than Paris to Calais, and no one would deny that the London and North Western is a great and energetic Company, but the best North Western express

takes 55 minutes longer between London and Manchester than the once-despised Chemin de Fer du Nord takes between Paris and Calais.

If we turn from France to America, the improvement in speed during the last decade is even more remarkable. Ten years ago, when our trains were booked to run from Euston to Perth, 450 miles, in 10 hours 15 minutes, the Americans claimed to be superior because they had once run a special train from Buffalo to Weehawken (New York) (see pp. 218 *et seq.*), 422·6 miles, in 9 hours 23 minutes, though their ordinary trains were admittedly a good deal slower. To-day the West Coast booked time to Perth has been brought down to 9 hours 20 minutes; while the East Coast time for its route, 440 miles, is 8 hours 59 minutes. But meanwhile the New York Central has put on its "Empire State Express," which originally was allowed 8 hours 40 minutes for the 440 miles from New York to Buffalo, but which, that allowance having been proved unnecessarily ample, has now for some years past been booked and has run, winter and summer, month after month, with a monotonously absolute punctuality such as no English line can pretend to rival, the 440 miles in $8\frac{1}{4}$ hours. The beating is not quite as bad as that which Euston receives from the French Nord; but who ten years ago would have dreamed that the Great Northern could be beaten by three-quarters of an hour by any railway company in the universe?

But even more remarkable than the Empire State Express are the services between Philadelphia and Atlantic City. Atlantic City, a favourite seaside resort of the central Atlantic states, is to Philadelphia much what Brighton is to London, except that Brighton and London are respectively some four times as big as the American cities. Two great companies, the Philadelphia and Reading and the Pennsylvania, compete for the traffic. Their trains start, not from Philadelphia itself, but from Camden, on the further bank of the Delaware river, the cross-river connec-

tion being made by ferry-boats. In fact, the position of things is much as though our own Brighton services started from London Bridge Station, and the ferry steamers of the Reading Company gave a connection with the Temple Pier, and those of the Pennsylvania connected with Paul's Wharf. The Pennsylvania, that is, has the shortest and best ferry route; on the other hand, its railway route is nearly 3 miles longer than that of the Reading Company, which latter is exactly 55½ miles in length.

The competitive summer service has long been excellent, but it was only in 1897 that it began to be phenomenal. In July of that year the Philadelphia and Reading put on a new train booked to cover the mile of ferry and the 55½ miles of rail in the level hour. Eight minutes were allowed for the river-crossing, leaving 52 minutes for the railway journey. This train ran every week-day during July and August. Out of these 52 days it arrived once to time, and on the remaining 51 days in front of time. The fastest journey took 46¾ minutes (=71·2 miles per hour), the slowest 50 minutes (=66·6 miles per hour); the average time was 47 minutes 52½ seconds (=say, 69½ miles per hour). In the summer of 1898 a slight alteration was made in the timing Eight minutes had been found insufficient for the ferry, so, the total duration of the journey remaining unaltered, the 1898 time-table allowed 10 minutes for the steamboat transfer, leaving 50 minutes for the 55½ miles railway run. The train ran on 53 days; it was once 2 minutes late, being brought to a dead stop half-way by a signal which either by accident or maliciously had been put to danger; twice it was exactly punctual; on the remaining 50 days it arrived before time. Nor were these extraordinary performances done with toy trains of 50 or 60 tons, such as those which our West Coast companies ran in the "race to Aberdeen" in July, 1895. The weight of the "Atlantic City Flyer," to give it its usual and well-deserved title, was, excluding engine, tender, passengers, and their baggage, 148

OPENING THE NEW MARYLEBONE TER[illegible] THE GREAT CENTRAL RAILWAY

English tons five days a week, and on Saturdays, when from 400 to 500 passengers were usually carried and two extra cars were added, well over 200 tons.

In 1897 the Pennsylvania Railroad, whose line was only single-track, and laid with light 60-lb. rails—rails which our Board of Trade would only pass for passenger traffic if the weight of the rolling stock was strictly limited, and the speed restricted to a maximum of 25 or 30 miles an hour—did not attempt to rival the Reading Company's speed, and confined itself to a modest 70 minutes, of which 5 minutes were allotted to the ferry, leaving 65 minutes for a rail journey of 58½ miles. But during the ensuing winter the Pennsylvania reconstructed its line, and laid a double track throughout with 100-lb. rails, and then in the summer of 1898 it, like its rival, ran a 60 minutes service. This last summer (1899) each company ran two sixty minute services. One day, when I happened to be on the engine (a Vauclain 4-cylinder compound) of the Reading train, we were brought to a standstill by signal soon after leaving Camden Station. Starting again we ran 54 miles in 45 minutes, and came in exactly "on time."

A comparison of these two services, whose booked speeds of 65 miles an hour or thereabouts from terminus to terminus means in practice running 50 miles on end at an average of fully 70 miles an hour, with our best English performances is simply humiliating. We have never in Great Britain had but two instances of runs booked at over 60 miles an hour, namely, Perth to Forfar, 31½ miles, in 31 minutes, now decelerated to 36 minutes, and a South Western booking of last summer, Dorchester to Wareham and back, of 15 and a fraction miles in 15 minutes. The following are the best runs that we in this country—I will not say can do, but do in fact accomplish, though we possess the most perfectly signalled and protected lines, the best steam coal, the best-trained staff of railway servants, and (at least according to English engineers) the best engines and the best permanent way in the world, over

BRACKLEY VIADUCT

stretches of road fairly comparable with those from Camden to Atlantic City: Victoria to Brighton and back, Sundays only (limited first-class), 51 miles, in 60 minutes; London Bridge to Brighton, 50½ miles, in 65 minutes; Manchester to Liverpool (Edgehill), 30 miles, in 35 minutes; Scarborough to York, 42 miles, in 50 minutes; Manchester, by the Cheshire Lines, to Stockport (Birkdale), 48½ miles, in 53 minutes; Edinburgh (Haymarket) to Glasgow (Cowlairs), 44½ miles, over a line as flat as a billiard-table, in 53 minutes.

Common honesty can only draw one deduction from the foregoing pages. Though England still remains unrivalled in the excellence of its express service taken as a whole, counting, that is, both the number of trains and their average speed, the best expresses of the world are no longer, as they were ten years ago, English; they are French or American. Assuming this fact admitted—and the English public have as yet, I think, hardly realised it—let us see what explanations or excuses are offered. Two only need be noticed. We are told, in the first place, that excessive speed—a question-begging phrase which might equally well have been, and was in fact applied to the 20 miles an hour of the 'Rocket' or the 40 miles an hour of the 'Wild Irishman' in the early sixties—is dangerous. The answer is absurd. The French maximum legal speeds are much lower, the average American maxima are certainly not higher, than our own actual maxima. But the inclusive speed abroad—*vitesse commerciale*, to use the apt French phrase—is higher than ours, because French and American engines are powerful enough to maintain uphill speeds which our engines can only maintain on the level, and on the level speeds which our engines can only maintain downhill. English expresses run at speeds of 75 and 80 miles per hour, and even more, every day of the week all over the country. If such speeds are excessive and dangerous, we have the excess and the danger with us here and now. But of course they are not dangerous with proper rolling-stock on a proper road under

proper conditions even downhill. Still less are similar or lower speeds dangerous on the level or uphill.

The second excuse, that the public doesn't want higher speed, deserves to be treated with, if possible, even less respect. A man in business in London with a house at Brighton is forced to spend at least $70 + 65 = 135$ minutes in the train every day. Its acceleration, not to the speed of the Atlantic City Flyer, but to a modest 60 miles an hour, would save him over half an hour a day. The statement that he wouldn't like to be saved it can really only be made with the tongue in the cheek. Or, again, to get to Manchester at 12.40 a Londoner has to leave Euston at 8.30. Are we asked seriously to believe that he would regard as an objectionable Gallicism the alteration of the hour of departure to 9.10 A.M.?

And, after all, great as are the material advantages of improved speed, not only to the individual, but often to whole communities—the citizens of Exeter and York, for instance, can do business in London and return home in the day; those of Plymouth and Newcastle cannot, but they might, if quite practicable accelerations were made—the matter is not merely material in its bearing. Improved speed means more perfect discipline, greater mechanical development, higher intellectual tension; it means, in fact, progress *versus* stagnation. England cannot afford to stagnate in railway matters any more than in other branches of commercial life; and, indeed, the results, I will not say of English stagnation, but of America's more rapid progress, are already abundantly manifest. Twenty years ago foreign railwaymen in search of new ideas and improved methods came, as a matter of course, to England. The books of Malézieux. Schwabe, Reitzenstein, and others who have described our English railways, are well known. To-day the intelligent foreigner thinks there is nothing new in English railway matters to be studied, and he accordingly betakes himself to America. One can hardly take up an American railway paper without seeing that such and such

a deputation of French, or German, or Russian, or Japanese engineers has been exploring the American railways. With the natural result. The American builders of locomotives and cars and bridges, the American rail-mills, and the American makers of automatic brakes, are already, whether it be in Africa, or Australia, or South America, in Russia, in China, or even in India, obtaining a firm foothold in markets of which not so long back England had practically a monopoly.

It cannot be that England, which invented railways, whose engineers and contractors and financiers have built railways in almost every country in the globe, will be content permanently to take second rank in railway matters. Ten years hence, let us hope, the story of the achievements and the progress of the railways of England will be, as it was ten years ago, one which the chronicler can record with pride. To-day it must be confessed that the tide of progress seems here to have reached high-water mark, if not to be actually receding, while on other shores the flood is still flowing free and full and strong.

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